(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
3 May 2001 (03.05.2001)

PCT

(10) International Publication Number
WO 01/31634 A1

(51) International Patent Classification[7]: G10L 15/00

(21) International Application Number: PCT/US00/29649

(22) International Filing Date: 27 October 2000 (27.10.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/431,305 28 October 1999 (28.10.1999) US

(71) Applicant: QENM.COM, INCORPORATED [US/US]; 327 El Granada Boulevard, Half Moon Bay, CA 94019 (US).

(72) Inventors: MISHELEVICH, David, J.; 20902 Garden Gate Drive, Cupertino, CA 95014 (US). LAMPHER, Ted, W.; 327 El Granada Boulevard, Half Moon Bay, CA 94019 (US).

(74) Agent: BOCCHIERI, Breton, A.; Arter & Hadden LLP, Two Embarcadero Center, 5th floor, San Francisco, CA 94111 (US).

(81) Designated States *(national)*: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW.

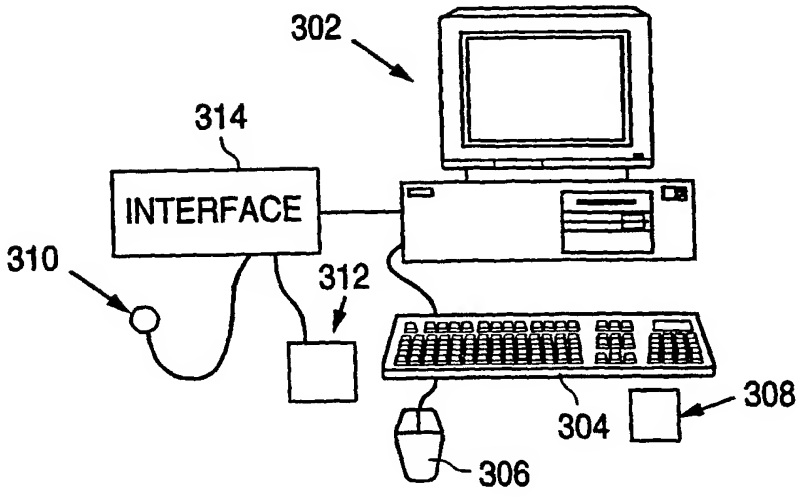
(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 01/31634 A1

(54) Title: PROOFREADING SYSTEM AND METHOD



(57) Abstract: A proofreading system and method in which data was orally entered, includes linking the sound file of the oral input data to the text file of the transcribed input data, and presenting the proofreader with audible (312) and visual (302) information. Soundex codes or speech recognition patterns are used to identify potentially incorrect data, and the proofreader is presented with alternatives to choose from. In the case of a structured document having different categories of information, alternatives specific to the particular category are generated. Where predefined portions of data are included, the system identifies such predefined data or automatically skips to the end of such data during proofreading.

PROOFREADING SYSTEM AND METHOD

BACKGROUND OF THE INVENTION

Field Of The Invention

This invention relates to a system and method of proofreading documents. In particular it relates to a system and method of proofreading documents that have been created using oral input and subsequently transcribed into text.

Description Of The Prior Art

Traditionally, people record information by means of hand written notes or by entering the information into a computer using standard word processing software. In the medical environment, healthcare professionals such as physicians and nurses record medical information about patients. This will include background about the patient, such as the patient's age and sex, patient history, physical examination, and subsequent information that is developed during discussions with the patient.

The physician typically requires the patient to fill out a questionnaire disclosing the personal information about the patient, the patient's background, medical information and pre-existing medical conditions. During the patient visit and thereafter the physician usually makes notes. As part of the process, the physician makes a determination regarding the patient's medical condition and defines a treatment plan.

Physicians often use a dictation and transcribing approach to record this information. However, the requirements upon physicians are becoming increasingly burdensome and tend to interfere with the physician's activities of examining patients. This applies equally to other applications in which data has to be recorded. Where oral data entry means are adopted, either software or a human being has to be employed to transcribe the oral input data. In either case, the transcribed text data is likely to include errors and requires proofreading to render a more accurate textual rendition of the oral input data.

Speech recognition software has recently become available for desk top computers, such as Dragon Dictate, and IBM VoiceType. Dragon Dictate can interface with different applications, including word processors. However, it suffers from the disadvantage that there is no audio recording of the dictation stored for replaying during editing. While the IBM VoiceType version retains both a sound and a text file, the text from the speech recognition engine is input directly into a propriety text processor. U.S. Patent 5,799,273 addresses the issue of allowing audio data to be stored corresponding to the edited text by updating the audio file when the text file is edited. None of the prior art, however, provides a facility for assisting a proofreader, such as highlighting suspicious text portions for the benefit of a proofreader, and no facility exists to associate positional information with the text to ensure that data input into a document having a predefined format and layout does not get corrupted during editing by inadvertently ending up in a different section of the document. What is needed is a system for substantially increasing the speed and efficiency of the proofreading of speech-

recognition generated documents. In particular, what is needed is a means for increasing the speed and efficiency of proofreading structured speech generated documents.

The present invention seeks to provide an efficient system and method of verifying and editing a structured document where the data was entered using oral input means.

SUMMARY OF THE INVENTION

According to the invention there is provided a method for proofreading a document having data that was orally input into the document and subsequently transcribed. One embodiment disclosed is a medical application. However, the invention is not so limited.

The input of the information by a user preferably involves the use of a computer and the use of speech-recognition software to transcribe the oral input data into text.

The system and method of the invention preferably involves connecting the user to a proofreader located at a remote site, by means of a Local-Area or Wide-Area computer network. The method may be implemented in a client-server system wherein all or some of the data is sent from the client to the server for evaluation. The data may, for example, include text that is proofread by a person on the server side or is transferred to a third party proofreader via a server or directly from the user who entered the data.

The method may include an accuracy monitoring capability to monitor, and possibly, make perceived corrective changes to the entered data. The method may, for instance, include a dictionary of undesired terms and/or a dictionary of desired terms which compares the entered data to the dictionary of words or phrases, and highlights and/or offers alternative terms or phrases from which to choose, or corrects perceived incorrect data.

The method typically checks the accuracy of oral data by performing acoustic checks, such as the use of Soundex codes or extended Soundex codes. Extended Soundex coding refers to assigning to the first letter, the category number which Soundex assigns to other letters, rather than using the letter itself for the first letter. The extended Soundex codes can be designed to check not only individual words but also multi-word phrases. The acoustic checking may include presenting the proofreader with alternative words and/or phrases once words and/or phrases are identified as potentially incorrect.

Typically the data is put into a document having a predefined structure. Thus, data entry may take the form of input into a predefined table or form having a certain layout. Different forms may be provided depending on the complexity of the case and the nature of the user. Structural information associated with the data may be retained through the use of a database or, if the data is serialized, by associating tags with the data, thereby retaining the structural information.

The system and method of the invention thus includes means for retaining the document structure during editing by a proofreader. The structure allows error checking by presenting alternatives to potentially erroneous data, wherein the alternatives are tailored to a given region of text.

The system and method of the invention includes means for accommodating the proofreading of documents where data was entered by way of predefined portions of data, such as text, hereafter referred to as a

macro. This may be done by marking the location of the macro in the document without inserting the data until after proofreading is complete, or by presenting the proofreader with the entire document including macros to permit data to be read in context.

The method and system can include scoring of data in which points or another quantitative measuring feature is ascribed to the data. The resultant score may be manipulated, such as by adding the points for a section of the document or for the document as a whole, to provide a quantitative measure, facilitating further action or a decision making process, such as supporting a given level of billing.

The points or other quantitative measure of the data input may serve to measure the qualitative and quantitative value of tasks performed by a user. For instance, a physician examining a patient, may be given points based on the extensiveness of the patient evaluation and the complexity of the diagnosis. He may also be given points based on the severity of the patient's illness or the amount of expertise required of the physician. Macros may cover more than one data entry location and can result in the assignment of points or filling in of scores for the associated multiple locations. These scores may be predefined or calculated by the system. During proofreading, editing of data may cause the points to change. Point changes are saved in association with the data by retaining structural information about the data.

The method is implemented on a computer system and the system may include functionality for prompting the user in order to maximize the points. Thus, the system may determine that the number of points for a particular section can be increased by entering merely one or two additional categories. By monitoring the accumulated points for a particular section or for the document as a whole, and by determining a distance to the next predetermined threshold level, the system may prompt the user for additional input. This may be achieved by providing a visual representation of the data collected, e.g., using a tree structure.

In order to assign points or other quantitative measures to the entered data, each piece of information is predefined as being associated with one or more points or other quantitative measure. Thus, a single response may include more than one element and have more than one point attributed to it.

Further, according to the invention there is provided a proofreading process, wherein data is entered orally using speech-recognition software. The process may be implemented on a system that includes a spell checker (for data that was entered using a keyboard or was entered by specifying the individual letters constituting a word) and/or a grammar checker. The system may also include a list of unexpected terms. This allows data corresponding to an unexpected term to be highlighted, alternatives presented, and/or replaced with an alternative. Where the term or terms are highlighted, a person acting as proofreader will be prompted to verify and, if necessary, correct the data entry.

The system stores the data both as a sound file and as a text file that is created pursuant to conversion by speech-recognition software. The proofreader receives both an audio version of the data and a text version that is synchronized with the audio version. As such, the method envisages the proofreader reviewing the text visually while simultaneously listening to the audio version. The proofreader may instead of the user, or in addition to the user, have speech-recognition software to transcribe the audio data. Words or phrases of

concern may be visually highlighted by the system in the text version. The audio version may also include a sound marker to identify a word or phrase of concern. Thus, the system includes transmitting both a sound file and a text file to the proofreader, synchronizing the two files and including means for highlighting or otherwise emphasizing words or phrases requiring specific attention of the proofreader. The text file may also include positional information associated with the data to define the location of the text in the document, and facilitate synchronizing the text and the sound data. The text file also includes points information about the data.

Changes made to the data by the proofreader are typically sent back to the user together with positional or structural information, and any points changes, to allow the data on the user side to be corrected, and also to teach the speech-recognition software.

In cases where data is entered in the form of a macro, the macros may immediately be inserted into the table, form, or other document and may be demarcated visually in the text version when displayed on a visual output device such as a computer monitor. The macro may also be audibly demarcated in the sound file to indicate to a listener, the beginning and the end of the macro. Alternatively, the insertion point of a macro may merely be indicated in the text file without actually inserting the data. It may, thus, be defined by a suitable visual indicator when viewed on a monitor, for example, by means of a key word. Similarly the insertion point of the macro in the sound file may be indicated by an audible tag such as a key word which is audible to the listener. Thus the proofreader need not get involved with the macro data, e.g., the wording, in the case of text data, and is merely provided with an indication as to the point of insertion of the macro in the rest of the document, or the macro text may be displayed but automatically skipped over. The macros and other data inserted into the document are associated with tags to ensure that the data may be stored in a database while retaining structural and other information about the data. The proofreader may be presented with some or all of the data, while some or all of the structural or other information (e.g., points allocated to the data) may be withheld from the proofreader. Sensitive data may also be withheld from the proofreader or require a password to restrict access.

Preferably the playback speed is adjustable by the proofreader, both the audio and text versions working in synchrony with each other to ensure that the text follows the playback of the sound file and vice versa. This is achieved, for example, by placing tags or synchronization markers in the text and sound file, or by including speech-recognition software and a search engine to locate a portion of the text file corresponding to a portion of the sound file, or by saving the text and corresponding sound file portions in one table or linked tables of the same database. Thus, the user can fast forward or rewind through either file or jump around in a file without losing synchronization.

Revenue streams may be obtained from users of the data entry software by providing the optional proof-reading service that can, conceivably, be performed at a remote low labor cost location.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic representation of a user interface;

Figure 2 is a simple schematic representation of a data capture system;

Figure 3 illustrates a speech-recognition system;

Figure 4 is a schematic overview of the internal architecture of a computer system;

Figures 5 and 6 illustrate data entry tables used in the invention;

Figure 7 is a serialized representation of some of the data of Figures 5 and 6;

Figure 8 is a flow diagram illustrating user input of data and scoring of the data;

Figure 9 is a flow diagram illustrating one embodiment of a proofreading process;

Figure 10 shows a user interface for a proofreader;

Figure 11 is a schematic block diagram showing the use of Soundex codes in the invention; and

Figure 12 is a table showing words and phrases, corresponding Soundex codes, and structural information in the form of categories with which the words and phrases are associated.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 shows a simple user interface 100 which can be implemented on any system based on a graphic user interface such as Microsoft Windows, Apple graphic interface, etc. The top area 102 of the user interface 100 constitutes the user text entry area. This area is typically provided with a predefined document entry format having specific user data entry locations 104. It will be appreciated that a form may have only one data entry location. This may take the form of a table with rows and columns, or a form or template (for example, for a patient encounter with a urology specialist versus a cardiology specialist), or other document having predefined sections. The lower part 106 of the user interface 100 presents the user with data or information retrieved by the system. The user interface 100 may also include buttons or icons 108 or a text entry area within the lower region 106 to establish a connection with an information provider or submit a request or inquiries such as questions on additional data or requests for samples or a conference call with an expert. The lower area 106 may also include a user selection facility 110 in the form of a drop down menu for selecting the user preferred method of information presentation. The interface also incorporates labels 112 which serve to prompt the user for input.

In one embodiment, proposed by the invention, data is entered by means of voice input in which speech-recognition software converts the sound input into text format. Text information is then displayed in an appropriate data entry location 104 in the form 100. The data that is entered, as well as any structural information or other information associated with the data, is saved in a database 200, as illustrated in Figure 2. Thus, the data capture system 202 includes a user interface which receives the user input, and facilitates the saving of the information in a database 200.

It will be appreciated that in the case of a voice activated system in which data is orally entered into the system, keywords may be established for use by the user to move around in the document and between the upper and lower portions of the user interface and to edit any of the data input or information retrieved. Thus information entered by the user into the upper portion 102 as well as information specifically requested in the lower portion 106 by the user can be used by the system, for example, a search engine to locate information relevant to the user's needs.

The invention envisages providing a variety of data entry templates, which may be selected from by the user to meet his or her needs. Thus, the templates may be specific to the area of expertise of the user, e.g., urology, and may further include more or less complex data entry templates, depending on the number of issues that are to be addressed. For instance, a urologist may have several templates to choose from in his field of expertise, depending on whether a particular patient is a first time patient requiring extensive consideration of background material such as family history, or not. The user is provided with buttons or a drop down menu, or other means from which to select an appropriate template.

Figure 3 illustrates a speech recognition system that includes a personal computer 302 having a keyboard 304 for inputting or editing text, and a mouse 306 for manipulating a cursor. The system further includes a storage medium such as a floppy disc 308 for loading applications into the computer. In a speech recognition environment, the applications would include speech recognition software that includes a speech recognition engine, a word processor and an interface to control the flow of text into the word processor and the flow of updated information from the word processor back into the speech recognition application to serve as part of the learning curve for the speech recognition software.

The system further includes a microphone 310, a speaker 312, and an interface 314. Audio signals from the user are sent from a microphone 310 to the interface 314 which converts the audio signal into a digital signal by means of an A - D converter. During playback of the recorded audio signal to the speaker 312, the interface 314 converts the digital signal back to an analogue signal by means of a D - A converter.

Figure 4 shows schematic overview of the internal architecture of a computer. The computer includes a processor 402, a read only memory 404, a random access memory 406, and a bus 408 that links the various components to the system. The random access memory (RAM) is used for storing application program systems and data for the speech recognition application. It will be appreciated that any application programs can be stored in ROM or another appropriate storage medium. The data for the speech recognition application comprises a user model 412 which can be updated to improve the accuracy of speech-recognition, a language model 414, and a dictionary 416 to which a user can add new words. The user model 412 includes an acoustic model and a contextual model. The acoustic and contextual models are typical components of a speech-recognition system, as known in the art, to assist in converting speech into text. In addition to such known models, the preferred embodiment of the invention proposes the use of Soundex codes, which involves retrieval of words and/or phrases that sound similar to those orally entered by the user, even though they may have different meanings, e.g., meet and meat. The present invention includes not only the standard dictionary of

desired terms 418 but also a dictionary of undesired terms 420. The system can therefore be set up to be user specific to include terms found in the user's particular field of art, storing these terms in the dictionary 418, and storing terms that would typically not be found in the user's area of expertise and storing these in the dictionary 420. The dictionaries 418, 420 can include categories so that alternatives presented can be matched to the context of the discourse. Thus, each of the dictionaries 418, 420 may comprise more than one separate dictionary tailored to different categories of interest, e.g., anatomical regions, symptoms, etc. The various categories may correspond to sections of the document or may be specific to one or more data entry locations. It will be appreciated that the various models may use the same sets of dictionaries 418 and 420.

As the speech recognition software converts the user's oral input into text a speech recognition interface 422 causes the data to the text processor application 424 to form a document 426 in memory. A display 430 also displays the text of the document 426.

The system also includes a non-volatile storage medium in the form of disc storage 432. The disc storage 432 includes a temporary directory used by the speech recognition engine for storing run time files containing the speech recognition output data. The disc storage 432 also includes a user's directory for storing document files emanating from the word processor and associated link data created by the speech recognition interface.

As is illustrated in Figure 2, captured information is stored on the database 200 in the form of objects. These objects thus have information associated with them such as properties pertaining to the objects and methods associated with the objects. In this manner data that is captured by the user may have structural information and points information, discussed in greater detail below, associated with the data. Thus, associated information can readily be saved in a database. In some cases it may be desirable to transfer the data in a flat file format, e.g., if the receiving device has limited memory and cannot support database management software. In such a case, the data and associated information is serialized, as illustrated in Figure 2, to transfer the information retrieved by a data capture application 202, to a location remote from the database, such as for data collection. Similarly, data to be placed into the database, is again, deserialized and the data stored in the appropriate rows or columns of the database table as defined by a database manager. It will be appreciated that the computers involved may take any one of a number of forms, e.g. laptops, palmtops, Personal Digital Assistants (PDAs), etc.

This is best illustrated in Figures 5, 6 and 7 in which Figure 5 shows a table 500 comprising rows, and columns. Similarly, Figure 6 illustrates a table 600, including rows and columns. These tables are to a large extent, illustrated in serialized form in Figure 7.

Table 500 identifies, in column 502, the patient identification number (PatientId). Column 504 gives the encounter of the patient, i.e., when the patient was seen and includes date entries. Column 506 identifies various element types or families of information which, in one embodiment, correspond to sections of the data entry form. Thus, each patient will have these elements associated with him or her. These include PROB relating to the type of problem associated with the patient, e.g., asthma, hypertension, etc., which are identified

in column 508 by identification numbers. Column 506 further includes elements relating to HPI (history of present illness), ROS (review of system), PFSH (past family and social history), PE (physical exam), CC (chief complaint), MDM (medical decision making), and an element permitting text substitution for a given keyword, identified here as MACRO. Column 510 identifies the order in which information is entered, e.g., CC will be inserted first, then HPI, followed by ROS, etc. Column 512 identifies the complexity of the case, and can be related to the score assigned to a particular task. Column 514 includes elements identifying the area of specialty, e.g., urology, or a general area called BASE. Column 516 adds prompt text corresponding to the internal elements of column 506. By using a separate column for the prompt text, a system can readily be implemented in any human language without having to adjust any of the internal elements. Column 518 elaborates on the type of problem associated with the patient.

Table 600 contains entries that are children of the entities in Table 500. Each row of Tables 500 corresponds to a separate element type, each element type, e.g., HPI, representing a collection of elements contained in Table 600 that have the same element type. Tables 500 and 600 present information about a number of patients as identified by the PatentId. Tables 500 and 600 represent information about all the patient encounters. All of the elements associated with a particular patient will have the same Patient ID as identified by column 602 of Figure 6. Among the PatientID records, those representing a given encounter will have the same Encounter ID, as illustrated by column 604. As illustrated in column 606, all of the entries associated with the Element Type "History of Present Illness" (HPI) from Table 500 are given as Element Type HPI. Column 608, entitled "DisplayName" lists various types of HPI by location of the illness, pain quality, pain severity, etc., and provides the text for the prompts to be displayed or to be spoken by the system to elicit specific information about a patient at a particular visit. Thus, the physician is prompted to identify the location of any pain, the pain quality, the pain severity, the pain timing, the duration, and other information about the patient's symptoms. The physician enters the data which is stored in column 610. The data type, e.g., text, is given in column 612. In the embodiment shown, column 614 is included to identify an internal code associated with the entered data. A score is assigned whenever data is entered. This may simply be one point per data entry or may be weighted to take account of qualitative factors in addition to quantitative factors. For example, the expertise of the physician, the amount of work involved in establishing and recording the data, and other qualitative and quantitative measures of the data entry can be considered in providing a score for a data entry. This is recorded in column 616. Column 618 identifies the person recording the data and, in the physician example, this can be either the physician or another medical staff member such as a nurse. Once the data entry for a particular row is complete, column 620 identifies the element by a check mark. The user can do this by verbalizing a predefined keyword, e.g., "enter", hitting a button on a keyboard, or any other input technique. Instead, the user may be given a predefined time period or system determined time period to enter the data, before the system identifies the data entry for that element as being complete, and moves to the next data entry location. Typically, the system moves to the next data entry location by prompting the user for data entry at the next location. Even where the time period for data entry is user determined or determined by the system, based

on past data entry rhythm or speed by the user, it will be appreciated that the timing may vary from one data entry location to the next. It will also be appreciated that predefined data, referred to herein as a macro, can cover more than one data entry location and be associated with a score of more than one point. Thus, a macro may deal with one or more groups of elements such as HPI or portions thereof, i.e., cover portions of one or more groups, e.g., pain quality and pain severity of HPI, and part or all of ROS. Where more than one data entry location are accommodated by a macro entry, the system will typically move to at least the next open data entry location for purposes of prompting the user for data entry.

In one embodiment, the identifier for the macro would appear multiple times in ElementCollection column 518 of Figure 5. Each appearance would have a different ElementType in the ElementType column 506, one for each group of elements (CC, HPI, ROS, PFSH, PE, etc.) that will have one or more elements in the table in Figure 6. Invoking this collection would pull out rows in Table 6 that have a ParentCollection identifier in column 622 that corresponds to the identifier in column 518. These identifiers could represent different categories such as elements from HPI, ROS, PE, or others.

An alternative embodiment is shown in the example illustrated in Fig. 5, the last row comprises a MACRO entry defined in column 508 as PREESWL. In lines 3 to 12 of Table 600, PREESWL is identified as comprising ten elements. As shown in column 606, these include HPI, two entries for PFSH (one for past history, and one for family history, as shown in column 608), an entry for ROS, four entries for PE, and two entries for MDM. As shown by column 622, the various entries are assigned a complexity of 2 and are given the text shown in column 610. It will be appreciated that the person defining the complexity can decide on the appropriate value depending on qualitative and/or quantitative factors such as the expertise required of the physician, the difficulty in making the determination, the time involved in making the determination, etc. The complexity value given in column 512 of table 500 is used as a weighting factor in this embodiment. Clearly, an embodiment could, instead, have merely one set of complexity values in either table 500 (to define the complexity for an element type) or table 600 (to define complexity on an element by element basis). In yet another embodiment the system could calculate appropriate complexity values as data is entered by the user. This could be based on various factors, including the time taken to enter the data, the expertise of the user, etc. Thus, in one embodiment, the system would provide a user input location for identifying the user. This would then be stored in column 618 for data entry rows associated with that session.

Figure 7 represents the serialized form of some of the information (not including information about the person regarding the data) given in tables 500 and 600. It shows the corresponding information in the third to eleventh rows, in which the third row corresponds to the associated information (tenth row) in Table 500 and the fourth to eleventh rows in Fig. 7 represent the corresponding information (thirteenth to twenty-eighth row) in Table 600 (except the information about the person recording the data). Thus, by defining the input data as objects having certain properties and methods, not only the data entered by the user, but also information about that data is retained for purposes of transmission. An example would be "Pain Severity: Five on a scale of ten"

where "Pain Severity would be the verbal tag that would ensure that the data "Five on a scale of ten" would be correctly placed in the document.

It will be appreciated, however, that instead of serializing the information the associated information may be transmitted by transferring the entire database or a portion thereof. An advantage of defining objects in a generalized object table is that properties and methods can be added or subtracted without changing the table structure by having to add or subtract columns. The table format retains the necessary associated information, such as, structural information, about the entered data.

As discussed with reference to Figure 1, the data input document is divided into sections requiring data entry into predefined data entry locations within the sections. However, it will be appreciated, that the entire data input document, which may take the form of a template or form as illustrated in Figure 1, or may be in the form of a table, may constitute only one section with one or more data entry locations. The data entry locations defined as 102 in Figure 1 are highlighted or otherwise prompted for user input as illustrated by Block 802 in Figure 8.

The user response 804 can take various forms, including no response at all, as illustrated by Block 806 in which case the user simply moves the cursor or other prompting feature to the next data entry location in the document. The user response may, instead, merely indicate that conditions are normal as illustrated by Block 808. In case of an abnormality in a patient's condition, the physician may specify the abnormality 810. The physician may insert or specify for insertion, predefined data such as text, which may take the form of a macro as illustrated by Block 812. This is retrieved by the user using keywords to insert the appropriate data. Instead, the user can be presented with a list of choices from which the user may then select the appropriate data.

The response from 804 together with a score associated with the data is then stored in a local storage mechanism 814, such as the database 200. A decision is made at 816 to determine whether all the data has been entered into the document. If not, the user is prompted for further input, 802. When all the data has been entered, the overall result is displayed as indicated by Block 818, and the information sent to a central data storage facility, as illustrated by Block 820.

As the user enters the data, he may become aware of data entry locations that he has missed and may move the cursor or other prompt to the specified location. This allows the user to jump around in the document and enter his data. In a preferred embodiment, the user is given the ability to indicate at a given point that additional text will be dictated later. The additional data may then be entered by the user or a third person at a later time.

In order to allow data to be entered by a user using a portable voice recording device such as a digital or analog voice recorder the preferred embodiment allows data entry locations to be orally specified by means of keywords. Any data that is entered, that is associated with the keyword, e.g., data that immediately follows a keyword, can subsequently be downloaded into the system without losing structural information and processed

in batch mode. Thus, the keywords serve as tags that link the subsequent data with particular data entry locations in the document.

Typically, however, the user will adopt a certain data entry sequence that may be monitored by the system and cause the system to automatically prompt the user for data input at the next system determined location. Thus, the system may be set up to automatically move on to the next section after a predefined period of time, or may monitor the user's input rate and rhythm to find an appropriate time delay before moving onto the next data input area. The rhythm can be established by measuring say one-and-a-half-times the average pause between elements of dictated input and assuming that if the user dictating has not uttered additional dictation by that time, that he or she does not want to provide further information for that data entry location. In a preferred embodiment, the user is provided with means for adjusting the prompting rate. A particular user may habitually enter data into only part of a form. The method includes a system in which data entry is monitored to ascertain a pattern, for example, data entered into certain rows and columns and leaving other rows and columns blank. By recording the data entry patterns of the last three sets of data entry, for example, the system may automatically highlight, or otherwise prompt, the user to input data at the next input location in the pattern. Thus the data entry sequence of column 510 in table 500 is adjustable by the system. The most likely next place of entry reflects what has happened in the immediate past. Thus if an abnormality is recorded in the recent part of the sequence, it is most likely that the next item will be abnormal as well.

In a preferred embodiment points or some other scoring is associated with the data input. A data entry location may involve data input which is associated with one or more points depending on the quantity or quality of the work associated with obtaining such information. For example, in a physician/patient environment, the extensiveness of the patient examination and the complexity of the symptoms and expertise required of the physician would be factors considered in determining the appropriate points to be allocated to the data required for entry into a particular data entry location. The system, according to the invention, also has the ability to arithmetically manipulate the scores, for example, by adding the points to determine a total score for a section or for the entire document. In a preferred embodiment, predetermined threshold levels are established. If it is determined by the system that the score for a certain section or for the document as a whole is within a predefined range of the next threshold level for that section or document, it prompts the user for further data input into data entry locations determined by the system to bring the total score up to the next higher level. For example, if a urologist dealing with the symptoms section of his examination accumulates a score of 18 points, and the system determines that a minor additional examination would take his point level up to the next higher score of 20, it could prompt the urologist for the appropriate additional input. In a preferred embodiment, he user is presented with a visual representation or depictions of the data entry locations that have data in them. This can take the form of one or more tree structure from which the user may select, thereby allowing him to view the information in the appropriate amount of detail. The visual depictions can differ in the amount of entered data they display, or the degree to which individual data enty locations, as opposed to

sections or groups of data entry locations are depicted. The breakdown of points can thus be readily ascertained and appropriate extra data entered to increase the score.

In order to improve the quality of the data entry and avoid unnecessary errors, the system includes a dictionary of undesired terms and/or a dictionary of desired terms directed toward the type of data entry of the particular user. For example, a urologist will typically use a specific set of terms and phrases in defining patient symptoms. The data input is compared to the dictionary terms, and any data input that falls outside the parameters of the dictionary of desired terms (which includes standard words such as "and" and "the") or within the undesired terms is highlighted. For example, the text is bolded or the color changed or other highlighting feature used, to draw the attention of the user to the suspicious data entry. The user may also be presented with alternative options that he or she may then enter or select from. Information is also fed back to the speech-recognition software as part of the learning mechanism of the software. Clearly, where data is input by the user using an input mechanism other than oral input, a dictionary of terms may still be included to verify data input. Spell checkers and grammar checkers may also be included to improve the quality of the data input. It will be appreciated that any prompting of the user for selection of an alternative or highlighting of a suspicious data entry, is not limited to visual prompting but could equally well include an audio prompt.

Input by the user may be achieved by any number of known methods, for example, using a keyboard, a touch sensitive screen, making use of character recognition software, etc. In the preferred embodiment data is, however, entered by vocal commands interpreted by speech-recognition software, which converts the oral data from the user into text and stores it as a text file. A number of speech recognition systems are currently on the market for desktop computers, including Dragon Dictate and IBM VoiceType. Preferably, the oral input is also saved as a sound file to assist in subsequent proofreading, as discussed in greater detail below.

In order to give the user feedback on the data he enters, he is provided with a display that displays the data entry table or form and any entered data. Depending on the user input screen chosen, the output, whether displayed or printed, will vary. One output is a transcription that looks like a document as it would normally appear (e.g., a medical chart). Another output is comprised of the filled out template elements including or not including the associated scores, perhaps with each new element on a separate line.

In one embodiment the user can be provided with an "I accept" button which allows the content of a given encounter/session to be locked. This output may be preceded by a processing phase in which the output of the speech recognition can be refined based on the additional contextual information (namely the whole document). One way to accomplish this would be to record all the decisions as they were made and review them in the light of the overall document by monitoring which contextual dictionaries or lexicons were used during completion of the form, identifying inconsistencies in the group of lexicons, and, by using appropriate substitution lexicons, revising words that were previously entered into sections based on the inconsistent lexicons.

As pointed out in Patent 5,799,273, it is advantageous to provide both a sound file and a text file, to assist in subsequent proofreading, and to link the two so that positional changes of characters are monitored and

linked and audio components are updated to allow playback of the sound file in synchronicity with the text file. One way of achieving this is described in the '273 Patent, using link means for forming link data between the audio portions and the corresponding character strings.

Thus, in the preferred embodiment, in which data is entered orally using speech-recognition software, both the text file and the original sound file are transmitted to the proofreader to allow the proofreader to view the text and listen to the oral sound file corresponding to the text. It is contemplated, in one embodiment, that the data entry system be linked by a network, such as an intranet, extranet, or the Internet to the proofreader who may be located in a different state or country. The sound and text files are synchronized with one another to allow the proofreader to simultaneously listen to the voice data while viewing the text data. The proofreader is also given the ability to jump forward or backward in the sound file and have the text portion track the sound file in synchronized fashion. Similarly, the user may scroll up or down in the text file and have the location in the sound file move backward or forward in synchronicity with the text file. This can be achieved in a number of ways, including the use of tags or synchronization markers in the text and sound files or by including speech-recognition software to monitor the next snippet of information on the sound file and converting this to text, thereafter locating the corresponding portion of the text file by means of a search engine as known in the art. In the case where tags are used, the tags in the sound file can comprise sound signals corresponding to the various data entry locations. In order to avoid distracting a proofreader during the proofreading process, the sound signals may be at a frequency above human speech and can be filtered out using a low-pass filter. Instead, a frequency range can be chosen for the signals, that is outside the range detectable by the human ear.

Another way to synchronize the files would be to place the beginning and perhaps end times for the speech related to a given category into a property of that object. For example, if History of Present Illness\Pain Severity began at 11:23:06 and ended at 11:23:11, those two times would appear as properties of that response in the record and would be available as tags in the text being proofread so allow synchronization with the elapsed time of the dictated speech.

In yet another embodiment the sound file and text file can be stored in the same table of a database or in linked tables of the same database. Thus the portion of the sound file corresponding to a section of text for one or more data entry locations can be saved in the database with the text data. For example, table 600 could merely be amplified to include a column for the sound file portions.

Information about a document as opposed to the actual data constituting the document may be incorporated by way of tags as is known and described in GML, ISO/ISC8879. Thus, by adding tags of a format control language such as XML, TeX or GML, abstract format information can be added to a document, thereby allowing the layout of the document to be changed without losing formatting. Thus, layout information can be changed, such as changing the column arrangements, without compromising the logical structure.

In the case of oral data input, the user typically has speech-recognition software on his own computer, thereby giving the user visual feedback on his data entry. One embodiment of the invention, however, contemplates the proofreader having additional, more powerful speech-recognition software, and using the

sound file to create a higher quality text file for purposes of proofreading and correction. Another embodiment contemplates using more powerful hardware and speech-recognition software system to preprocess the dictation prior to its reaching the proofreader.

One embodiment of the proofreading process is illustrated in Figure 9 in which the input data stream 902 optionally is preprocessed in block 904, either on the user side or on the proofreader side, or both, and special words or phrases are marked. These special words or phrases may automatically be corrected by the system, or are corrected by the user or proofreader. Instead, the system may present the user or proofreader with alternatives for replacing the suspicious data. Any preprocessing of Block 904 may involve input from spell checkers (insofar as data was spelled out to the speech-recognition software or was entered by other means that could introduce spelling errors) and grammar checkers, monitoring the input into the data file. In Block 906, the text file and sound file 908 are played back in synchronized form. Further input verification and improvement takes place in step 910 in which the speech recognition software, either on the user side or the proofreader side, causes alternatives to words that are potentially erroneous to be displayed. Dictionaries may be set up for the particular user's needs. The dictionaries may include separate one word, two word, three word, etc., dictionaries to propose alternatives for various lengths of phrases. Thus, different lengths of text can be highlighted (e.g., reverse video, font style, font color, field background color). Proposed alternatives of different lengths can be presented in a single list, in lists of defined mixtures of lengths (e.g., two lists, one with phrases with three words or fewer and one with phrases of four words or more) or may appear in separate lists, each containing phrases of the same number of words.

In one embodiment, the proofreader can select among alternative words/phrases or perform other functions such as increasing or decreasing audio playback speed by using voice commands, tactile controls (e.g., computer-game joy sticks, including additional buttons, or other platforms), eye movements or blinks, foot pedals, muscle twitches, and other bionic inputs.

In addition to software mechanisms for improving the quality of the data input, the proofreader edits the data by taking note of highlighted sections and by reading the document in context to ensure consistency. In the event that the proofreader is not in a position to make a determination, one embodiment of the invention proposes the use of experts, such as oversight work stations, to make a final decision. In a situation where an oversight work station is not available or is also not in a position to make a final decision, the region of text in issue is marked and returned to the originating organization, namely, the user for appropriate selection or correction. This is indicated by Block 912. Thus, the proofreader or oversight work station or user may cause text to be corrected. As illustrated in Block 914, the corrected text is saved into the database or serialized document as discussed with reference to Figure 2 above. The corrected structured or unstructured file, or only the portions that were changed, is then returned to the user in Block 916 and updates the text in the patient-encounter record. In the case of a structured document, positional or structural information is sent back with the data to permit the appropriate data locations on the user side, e.g., in the user database, to be corrected, and any changes in scoring, to be reflected on the user side.

Thus, the changes in the text may result in different information being put into the data entry locations. This may affect the scoring associated with such data. In one embodiment, it is contemplated that the user, upon receiving the returned data file, is again prompted for additional data input where the score for a certain section or for the entire document is within a predetermined desired point range. If the user is not inclined to make further changes once it is returned to him by the proofreader, he may, at least, take note of areas where he could have gained further points, for future data entry sessions.

The feedback from the proofreader in the form of the selection of particular options of text are also returned together with the audio snippets for purposes of retraining the speech recognition software, as is illustrated by Blocks 918 and 920. Final files or the changed portions of the files are returned to the user for replacing the original files or file portions (both continuous text output and individual structured elements in the database as illustrated by Block 922.)

An embodiment of the user interface for transcription proofreading is shown in Figure 10. In this example, only one type of alternative is presented, that for the single word, but other display boxes displaying phrases of different lengths can easily by displayed. The text being proofread is displayed in text box 1002. Its height and width can be varied using controls 1004 and 1006 for height and 1008 and 1010 for width to adjust the display for individual proofreader preference. Each word or phrase of the text in 1002 can be highlighted, say the word "damning" to draw the attention to the proofreader to the current point of action. In a preferred embodiment the document has predefined regions having lexicons associated with the regions that are specific to the topic covered by the region. The application alternatives are determined (at least in terms of priority of presentation) by the categories that the text being analyzed satisfies, if the text being analyzed has been so structured. The applicable alternative(s) at that point of text is displayed in a list box 1012 with the identification number(s) 1014 of the alternative(s) listed to its left. At each point where an alternative is to be considered, a dialogue box 1016 is presented in which the identification number of the desired selected alternative is input. A non-selection can be indicated by putting in a special number, say 0, or other character. Alternatively, the interface can be set up so the selections are made using a point-and-click mechanism. In addition, if that particular word (or phrase) is to be replaced by text not shown as an alternative or alternatives have not been presented, the appropriate button 1018 is pressed and a dialogue box brought up in which the replacement text can be input. In a preferred embodiment, as an aid to the proofreader, certain parameters are displayed such as the current word count 1020, the elapsed time 1022, and the current average words per minute 1024 for processed input already proofread. The proofreader may adjust the scan rate using buttons 1026.

Thus, the proofreader can select among alternative words/phrases or perform other functions such as increasing or decreasing audio playback speed. These selections may be made by using voice commands, tactile controls (e.g., computer-game joy sticks, including additional buttons, or other platforms), eye movements or blinks, foot pedals, muscle twitches, and other bionic inputs.

As illustrated by Figure 11, Soundex codes may be used to send phonetically similar codes as alternatives for selection by the user and/or the proofreader. Soundex words and phrases are stored as illustrated in Block 1102. These words emanate from predefined words categorized into certain categories. For example, the Soundex files may be categorized into various section such as patient history, cardiovascular section, heart, thorax, and an unspecified section, as illustrated by Block 1104. The categories may be organized hierarchically so that selections can be made based on the desired scope. Data is input into the various categories as illustrated by Block 1106. Resultant categories with their data are then stored in a storage medium 1008. Alternatively, categorized voice-recognition segments may be used to generate and display text alternatives.

Figure 12 illustrates a data base implementing the Soundex codes. Typical Soundex codes take the form of a letter followed by several numbers, e.g., five numbers, where the letter corresponds to the first letter of a word and the numbers depict the consonants in the word following the first letter. Consonants that sound the same such as "c" or "k" are given the same number, and double consonants, such as "ll" are treated as a single consonant. In order to take account of possible errors in the first letter, extended Soundex cards may be used. In Table 1200, depicted in Figure 12, column 1202 shows extended Soundex codes made up of 19 numbers that represent the words or phrases in column 1204. Instead of retaining the first letter of the word they depict, these extended Soundex codes codify the first letter of the word in the same manner as the rest of the letters. As shown in 1202, codes represent the words or phrases and any unused portion of the 19 digits is filled with zeroes. As mentioned with respect to Figure 11, the Soundex files of the preferred embodiment are categorized into various sections which are depicted in Figure 12 by columns 1206, 1208, 1210, 1212, and 1214. Column 1216 shows an alternative implementation of Soundex codes corresponding to the words and phrases in column 1204.

The invention has been described with reference to an example involving a physician and patient. It will be appreciated that the invention is equally applicable to any data capture and proofreading environment not just medical. Furthermore, the reference to speech-recognition software is not to be seen as the only way in which data can be captured. Thus the system and method as defined by the claims of the invention is not to be read as limited to specific embodiments described in the specification.

What is claimed is:

1. A method of proofreading the text data of a document in which the data was entered orally by a user and transcribed into text form by speech-recognition software on a user computer system, comprising:

comparing the oral input data or the transcribed text data to at least one dictionary of terms to identify potentially incorrectly transcribed data;

identifying the potentially incorrectly transcribed data;

linking the oral input data and the transcribed text data,

reviewing the text data in conjunction with the oral input data, and

making corrections to the text data.

2. The method of Claim 1, wherein the dictionary of terms includes at least one of, a dictionary of desired terms comprising terms likely to be found in the document, and a dictionary of undesired terms comprising terms unlikely to be found in the document.

3. The method of Claim 1, wherein the terms include at least one of, individual words, and phrases.

4. The method of Claim 1, wherein the identifying includes at least one of, audibly highlighting the oral data, and visually highlighting the text data.

5. The method of Claim 4, wherein the visual highlighting includes at least one of, bolding the text, changing the font of the text, changing the color of the text or its background, and presenting alternative text options for replacing the incorrect data.

6. The method of Claim 1, wherein the text data is stored in a text file, and the oral data is stored in a sound file, and the linking synchronizes the text file and the sound file to allow a proofreader to scroll up and down in the text file while ensuring a corresponding position change in the sound, and allows the proofreader to move around in the sound file while ensuring that the location in the text file is adjusted accordingly.

7. The method of Claim 1, wherein the data includes predefined data inserted into the document and wherein the predefined data is identified by at least one of, visual indicators in the display of the text file, and audible indicators in the playback of the sound file.

8. The method of Claim 7, wherein the visual indicators include at least one of, visual markers at the beginning and end of the inserted predefined data, different font for the inserted predefined data, and different color for the inserted predefined data or its background.

9. The method of Claim 7, wherein the audible indicators include at least one of, sounds or words identifying the beginning and end of the inserted predefined data.

10. The method of Claim 1, wherein the data includes predefined data inserted into the document and wherein the proofreader uses a computer system to edit the text data, and wherein predefined data is skipped over during editing.

11. The method of Claim 1, wherein the text data is stored in a text file, and the oral data is stored in a sound file, and wherein predefined data specified by the user for insertion into the document are marked in at least one of the text file and the sound file, for later insertion.

12. The method of Claim 1, wherein the proofreading is done by a proofreader at a location remote from the user and the proofreader does the proof reading using a computer linked by at least one network to the user computer system.

13. The method of Claim 1, wherein identifying potentially incorrectly transcribed data includes presenting alternatives.

14. The method of Claim 13, wherein the comparing is performed by the computer system using acoustic analysis.

15. The method of Claim 13, wherein the alternatives are generated based on speech-recognition segments.

16. The method of Claim 14, wherein the alternatives are generated based on Soundex codes.

17. The method of Claim 13, wherein the document includes a plurality of regions dealing with different categories of information.

18. The method of Claim 17, wherein the alternatives being presented are specific to the categorization of the text.

19. The method of Claim 1, wherein a proofreader has a second, more powerful, speech-recognition software.

20. The method of Claim 17, wherein structural information defined by the plurality of regions is associated with the text data.

21. The method of Claim 17, wherein the data includes predefined data inserted into at least one of the predefined regions.

22. A method of improving the accuracy of the text data of a structured document in which the data was entered orally and transcribed into text form by voice recognition software, comprising:

associating the text data with positional information;

linking the oral input data and the transcribed text data,

reviewing the text data in conjunction with the oral input data, and

making corrections to the text data.

23. The method of Claim 22, wherein the text data is stored in a text file, and the oral data is stored in a sound file, and the linking synchronizes the text file and the sound file to allow a proofreader to scroll up and down in the text file while ensuring a corresponding position change in the sound, and allows the proofreader to move around in the sound file while ensuring that the location in the text file is adjusted accordingly.

24. The method of Claim 22, wherein the text data includes predefined data inserted into the document and wherein the predefined data is identified by at least one of, visual indicators in the display of the text file, and audible indicators in the playback of the sound file.

25. The method of Claim 24, wherein the visual indicators include at least one of, visual markers at the beginning and end of the inserted predefined data, different font for the inserted predefined data, and different color for the inserted predefined data or its background.

26. A method of Claim 24, wherein the audible indicators include at least one of, sounds or words identifying the beginning and end of the inserted predefined data.

27. A method of Claim 22, wherein the text data is stored in a text file, and the oral data is stored in a sound file, and wherein predefined data specified by the user for insertion into the document is marked in at least one of the text file and the sound file, for later insertion.

28. The method of Claim 22, wherein the reviewing is done by a proofreader at a location remote from the user and the proofreader does the reviewing using a computer linked by at least one network to the user computer.

29. The method of Claim 28, wherein the data includes predefined data inserted into the document and wherein the proofreader uses a computer system to edit the text data, and wherein predefined data is skipped over during review.

30. The method of Claim 22, further comprising identifying potentially incorrectly transcribed data.

31. The method of Claim 30, wherein the identifying includes using acoustic analysis.

32. The method of Claim 30, wherein the identifying includes presenting alternatives.

33. The method of Claim 32, wherein the alternatives are generated based on speech-recognition segments.

34. The method of Claim 32, wherein the alternatives are generated based on Soundex codes.

35. The method of Claim 32, wherein the document includes a plurality of regions dealing with different categories of information.

36. The method of Claim 35, wherein the alternatives being presented are based on the categorization of the text to be analyzed on the basis of one or more categories.

37. The method of Claim 23, wherein the proofreader has a second, more powerful, speech-recognition software.

38. A system for creating a text document from a sound file containing oral data, comprising:

speech-recognition software to transcribe the oral data into text data;

means for checking the accuracy of the transcribed data, which includes means for generating at least one of, words and phrases that are acoustically similar to words or phrases in the oral data, and

means for presenting alternative words or phrases for user selection.

39. A system for proofreading and editing text data where the text data was generated from oral input data, using speech-recognition software, comprising:

means for checking the accuracy of the text data, which includes means for generating at least one of, words and phrases that are acoustically similar to words or phrases in the oral data, and

means for presenting alternative words or phrases for user selection.

40. The system of Claim 39, wherein the text data is stored in a text file, and the oral data is stored in a sound file, and wherein the text file and sound file are linked to permit a proofreader to view the text data and hear the corresponding oral data.

41. The system of Claim 39, wherein the oral data was input into a document having a predefined structure with a plurality of data entry regions dealing with different categories of information, and wherein the means for generating at least one of, words and phrases tailors the words or phrases to each region's category.

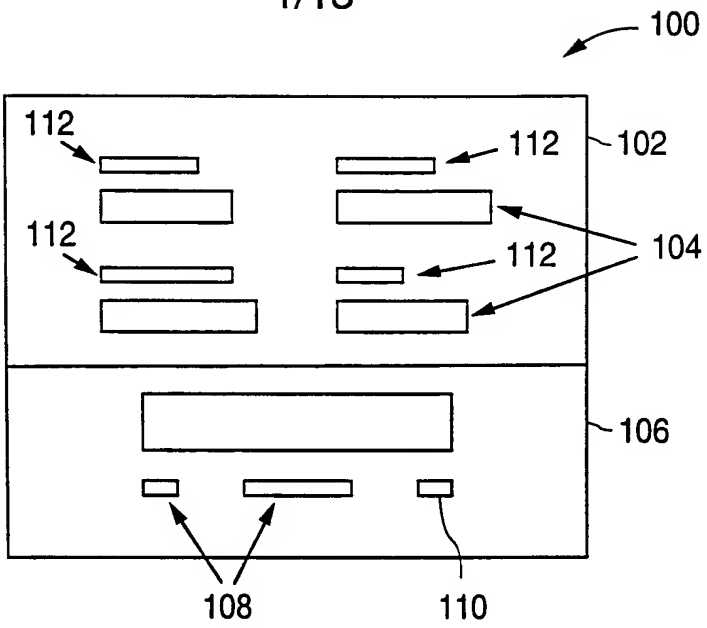


FIG. 1

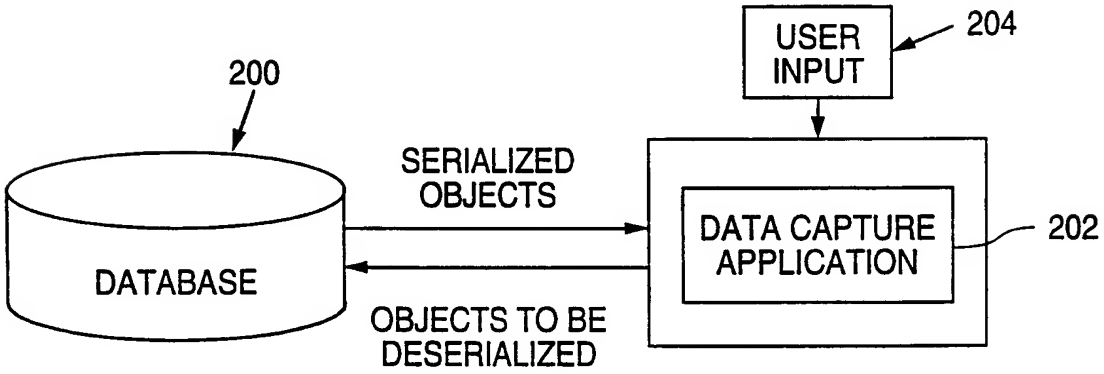


Fig. 2

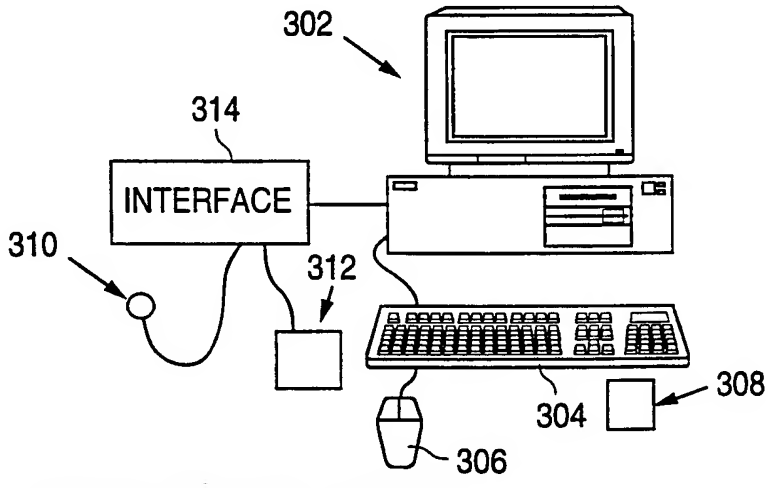


FIG. 3

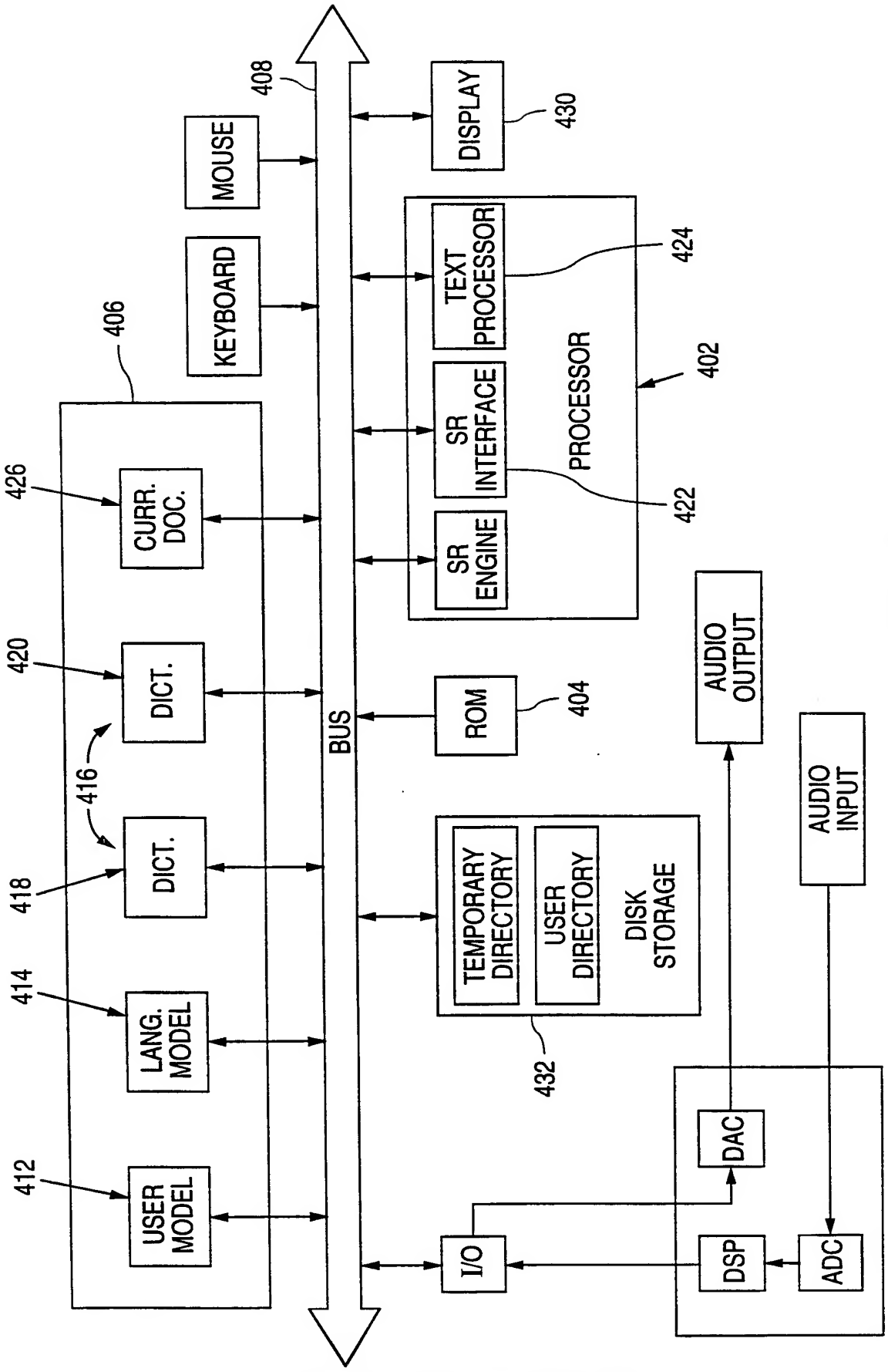
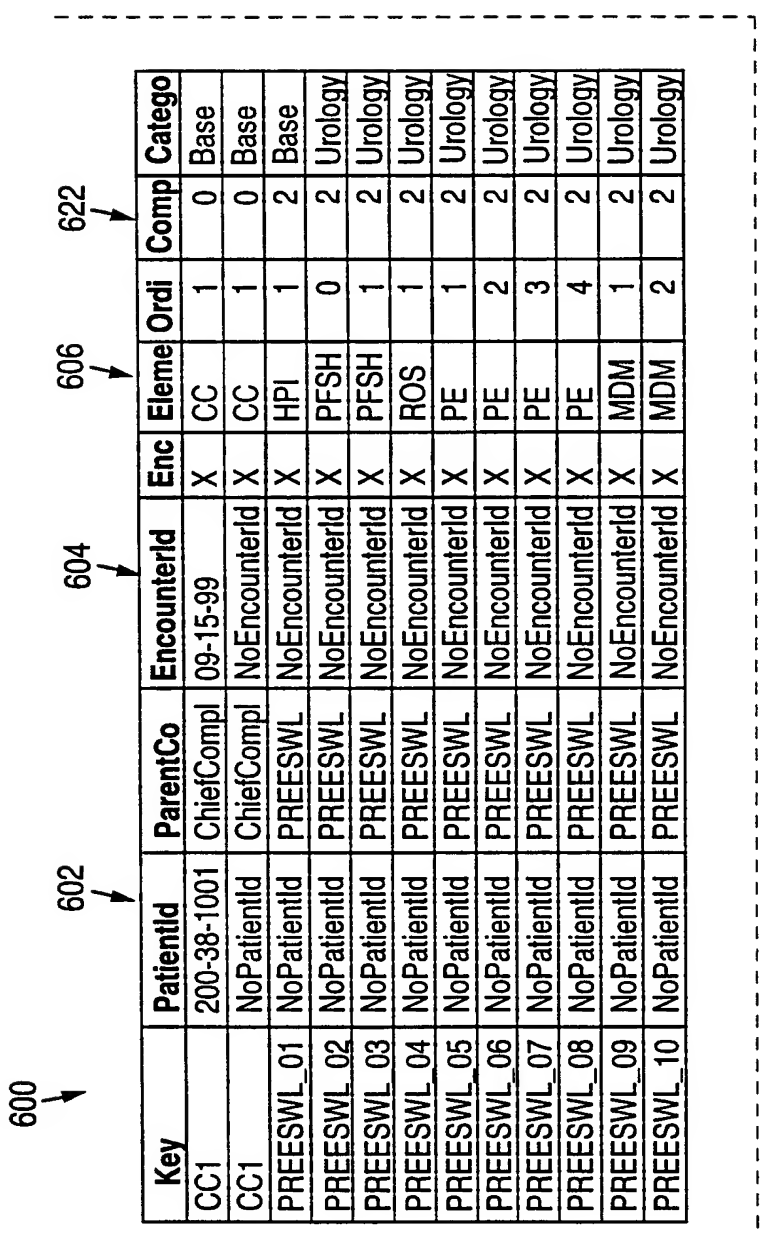

408
MOUSE
KEYBOARD
406
426
CURR. DOC.
420
DICT.
416
418
DICT.
414
LANG. MODEL
412
USER MODEL
BUS
DISPLAY
430
TEXT PROCESSOR
424
SR INTERFACE
SR ENGINE
PROCESSOR
402
422
ROM
404
TEMPORARY DIRECTORY
USER DIRECTORY
DISK STORAGE
432
AUDIO OUTPUT
AUDIO INPUT
DAC
I/O
DSP
ADC

FIG. 4

FIG. 5

500

Key	PatientId	EncounterId	Enco	Element	OrdinalF	Comple	Category	AssocPro	DisplayName	ElementCollecti
111111	200-38-1001	09-15-99	X	PROB	6		Base	Table6	Problems	111111
111111	NoPatientId	NoEncounterId	X	PROB	6		Base	Table6	Problems	111111
598.0	200-38-1001	09-15-99	X	PROB	6	0	Urology	Active	Problems	598.0
598.0	NoPatientId	NoEncounterId	X	PROB	6	0	Urology	Active	Problems	598.0
944444	200-38-1001	09-15-99	X	PROB	6	0	Urology	Table6	Problems	944444
944444	NoPatientId	NoEncounterId	X	PROB	6	0	Urology	Table6	Problems	944444
999888	200-38-1001	09-15-99	X	PROB	6	0	Urology	Table0	Problems	999888
999888	NoPatientId	NoEncounterId	X	PROB	6	0	Urology	Table0	Problems	999888
Hytrin	NoPatientId	NoEncounterId	X	MDM	1	1	Urology-Smith	None	MDM-Hytrin	MDM-Hytrin
Key1	200-38-1001	09-15-99	X	HPI	1		Base	Table1	HPI	HPIIlness
Key1	NoPatientId	NoEncounterId	X	HPI	1		Base	Table1	HPI	HPIIlness
Key2	200-38-1001	09-15-99	X	ROS	2		Base	Table2	ROS	ROSystems
Key2	NoPatientId	NoEncounterId	X	ROS	2		Base	Table2	ROS	ROSystems
Key3	200-38-1001	09-15-99	X	PFSH	3		Base	Table3	PFSH	PFSHistory
Key3	NoPatientId	NoEncounterId	X	PFSH	3		Base	Table3	PFSH	PFSHistory
Key4	200-38-1001	09-15-99	X	PE	4		Base	Table4	Physical Examinatio	Pexamination
Key4	NoPatientId	NoEncounterId	X	PE	4		Base	Table4	Physical Examinatio	Pexamination
Key5	200-38-1001	09-15-99	X	MACRO	5	0	Base	Table5	Macros	MacroSet
Key5	NoPatientId	NoEncounterId	X	MACRO	5	0	Base	Table5	Macros	MacroSet
Key6	200-38-1001	09-15-99	X	CC	0	0	Base	Table6	Chief Complaint	ChiefComplaints
Key6	NoPatientId	NoEncounterId	X	CC	0	0	Base	Table6	Chief Complaint	ChiefComplaints
Key7	200-38-1001	09-15-99	X	MDM	1	1	Base	None	Prescription	MDM-RX
Key7	NoPatientId	NoEncounterId	X	MDM	1	1	Base	None	Prescription	MDM-RX
PREESWL	NoPatientId	NoEncounterId	X	MACRO	1	1	Urology-Smith	None	PREESWL	PREESWL
508	502	504		506	510	512	514		516	518

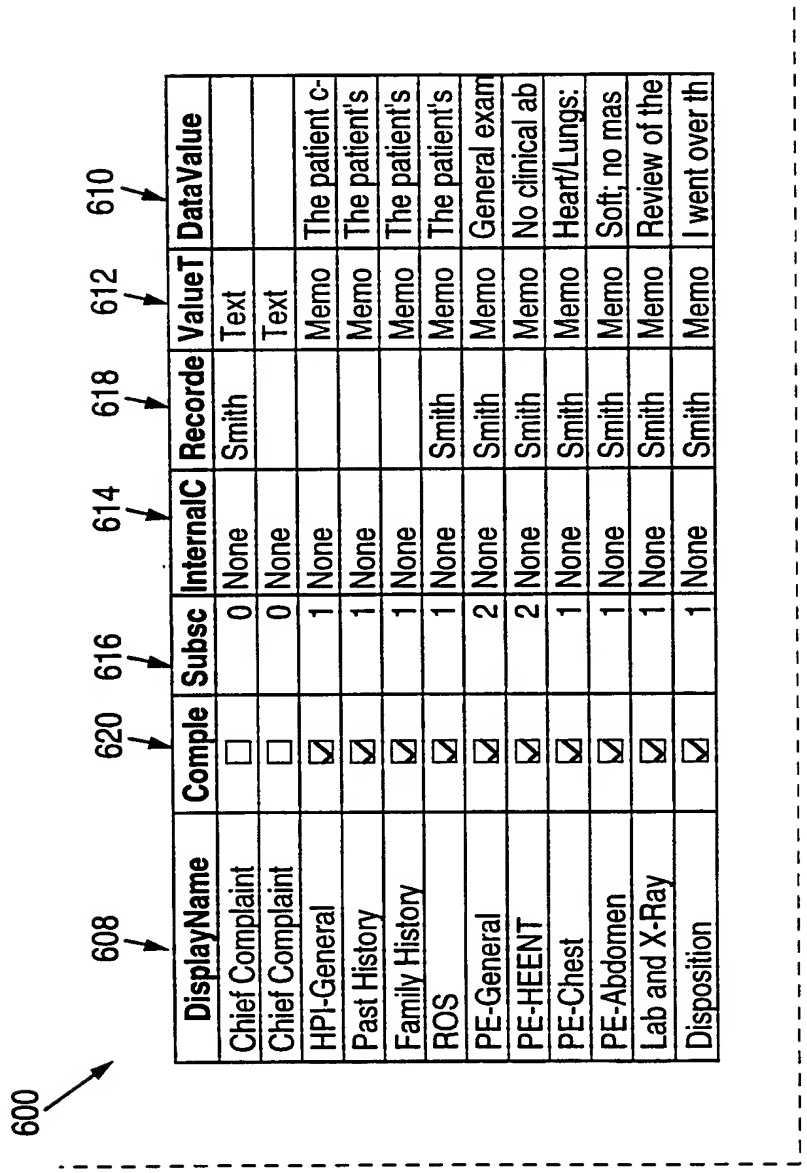


Key	PatientId	ParentCo	EncounterId	Enc	Eleme	Ordi	Comp	Catego
CC1	200-38-1001	ChiefCompl	09-15-99	X	CC	1	0	Base
CC1	NoPatientId	ChiefCompl	NoEncounterId	X	CC	1	0	Base
PREESWL_01	NoPatientId	PREESWL	NoEncounterId	X	HPI	1	2	Base
PREESWL_02	NoPatientId	PREESWL	NoEncounterId	X	PFSH	0	2	Urology
PREESWL_03	NoPatientId	PREESWL	NoEncounterId	X	PFSH	1	2	Urology
PREESWL_04	NoPatientId	PREESWL	NoEncounterId	X	ROS	1	2	Urology
PREESWL_05	NoPatientId	PREESWL	NoEncounterId	X	PE	1	2	Urology
PREESWL_06	NoPatientId	PREESWL	NoEncounterId	X	PE	2	2	Urology
PREESWL_07	NoPatientId	PREESWL	NoEncounterId	X	PE	3	2	Urology
PREESWL_08	NoPatientId	PREESWL	NoEncounterId	X	PE	4	2	Urology
PREESWL_09	NoPatientId	PREESWL	NoEncounterId	X	MDM	1	2	Urology
PREESWL_10	NoPatientId	PREESWL	NoEncounterId	X	MDM	2	2	Urology

FIG. 6A

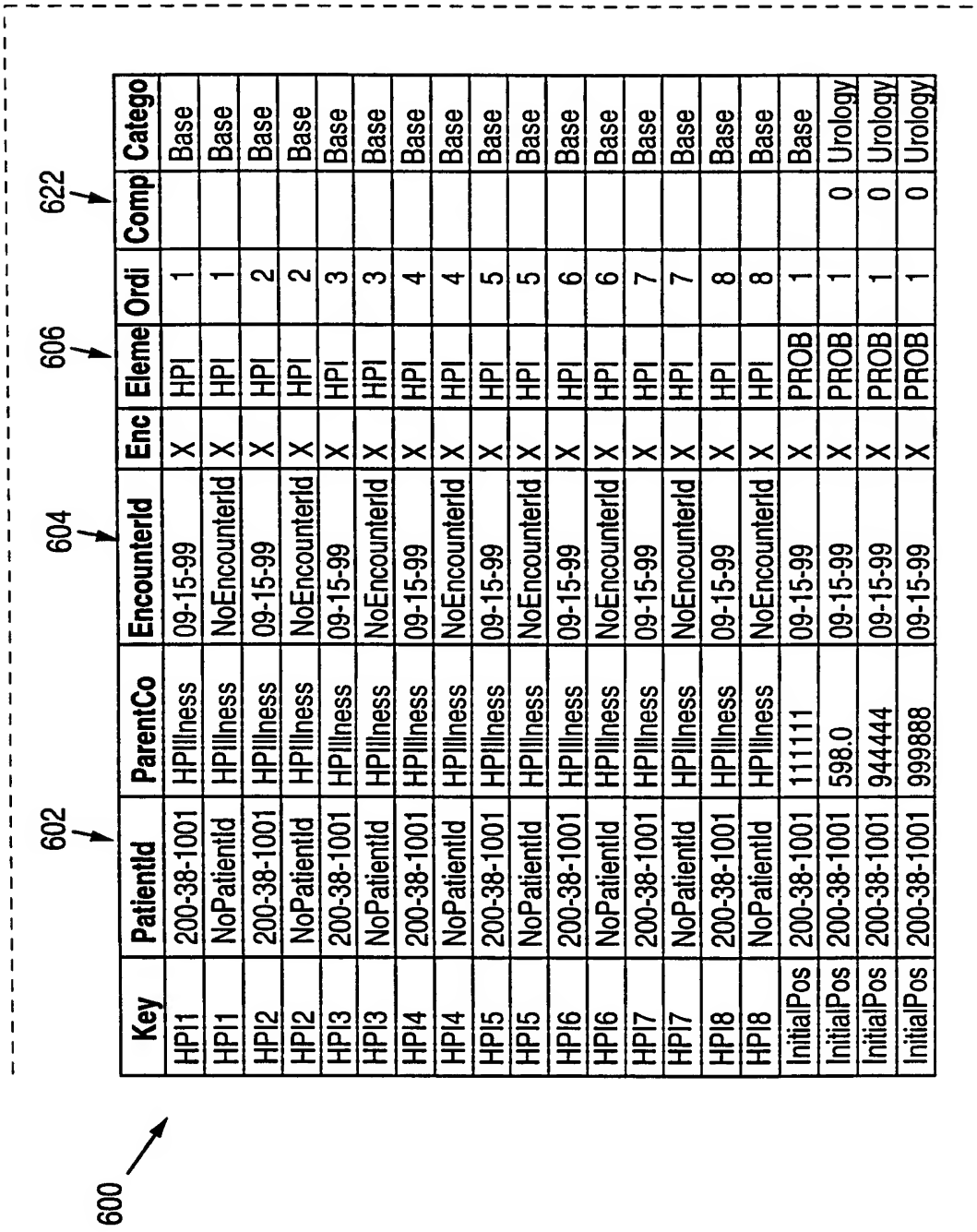
FIG. 6

FIG. 6A	FIG. 6B
FIG. 6C	FIG. 6D



DisplayName	Comple	Subsc	InternalC	Recorde	ValueT	DataValue
Chief Complaint	☐	0	None	Smith	Text	
Chief Complaint	☐	0	None		Text	
HPI-General	☑	1	None		Memo	The patient c-
Past History	☑	1	None		Memo	The patient's
Family History	☑	1	None		Memo	The patient's
ROS	☑	1	None	Smith	Memo	The patient's
PE-General	☑	2	None	Smith	Memo	General exam
PE-HEENT	☑	2	None	Smith	Memo	No clinical ab
PE-Chest	☑	1	None	Smith	Memo	Heart/Lungs:
PE-Abdomen	☑	1	None	Smith	Memo	Soft; no mas
Lab and X-Ray	☑	1	None	Smith	Memo	Review of the
Disposition	☑	1	None	Smith	Memo	I went over th

FIG. 6B



Key	PatientId	ParentCo	EncounterId	Enc	Eleme	Ordi	Comp	Catego
HPI1	200-38-1001	HPIllness	09-15-99	X	HPI	1		Base
HPI1	NoPatientId	HPIllness	NoEncounterId	X	HPI	1		Base
HPI2	200-38-1001	HPIllness	09-15-99	X	HPI	2		Base
HPI2	NoPatientId	HPIllness	NoEncounterId	X	HPI	2		Base
HPI3	200-38-1001	HPIllness	09-15-99	X	HPI	3		Base
HPI3	NoPatientId	HPIllness	NoEncounterId	X	HPI	3		Base
HPI4	200-38-1001	HPIllness	09-15-99	X	HPI	4		Base
HPI4	NoPatientId	HPIllness	NoEncounterId	X	HPI	4		Base
HPI5	200-38-1001	HPIllness	09-15-99	X	HPI	5		Base
HPI5	NoPatientId	HPIllness	NoEncounterId	X	HPI	5		Base
HPI6	200-38-1001	HPIllness	09-15-99	X	HPI	6		Base
HPI6	NoPatientId	HPIllness	NoEncounterId	X	HPI	6		Base
HPI7	200-38-1001	HPIllness	09-15-99	X	HPI	7		Base
HPI7	NoPatientId	HPIllness	NoEncounterId	X	HPI	7		Base
HPI8	200-38-1001	HPIllness	09-15-99	X	HPI	8		Base
HPI8	NoPatientId	HPIllness	NoEncounterId	X	HPI	8		Base
InitialPos	200-38-1001	111111	09-15-99	X	PROB	1		Base
InitialPos	200-38-1001	598.0	09-15-99	X	PROB	1	0	Urology
InitialPos	200-38-1001	944444	09-15-99	X	PROB	1	0	Urology
InitialPos	200-38-1001	999888	09-15-99	X	PROB	1	0	Urology

FIG. 6C

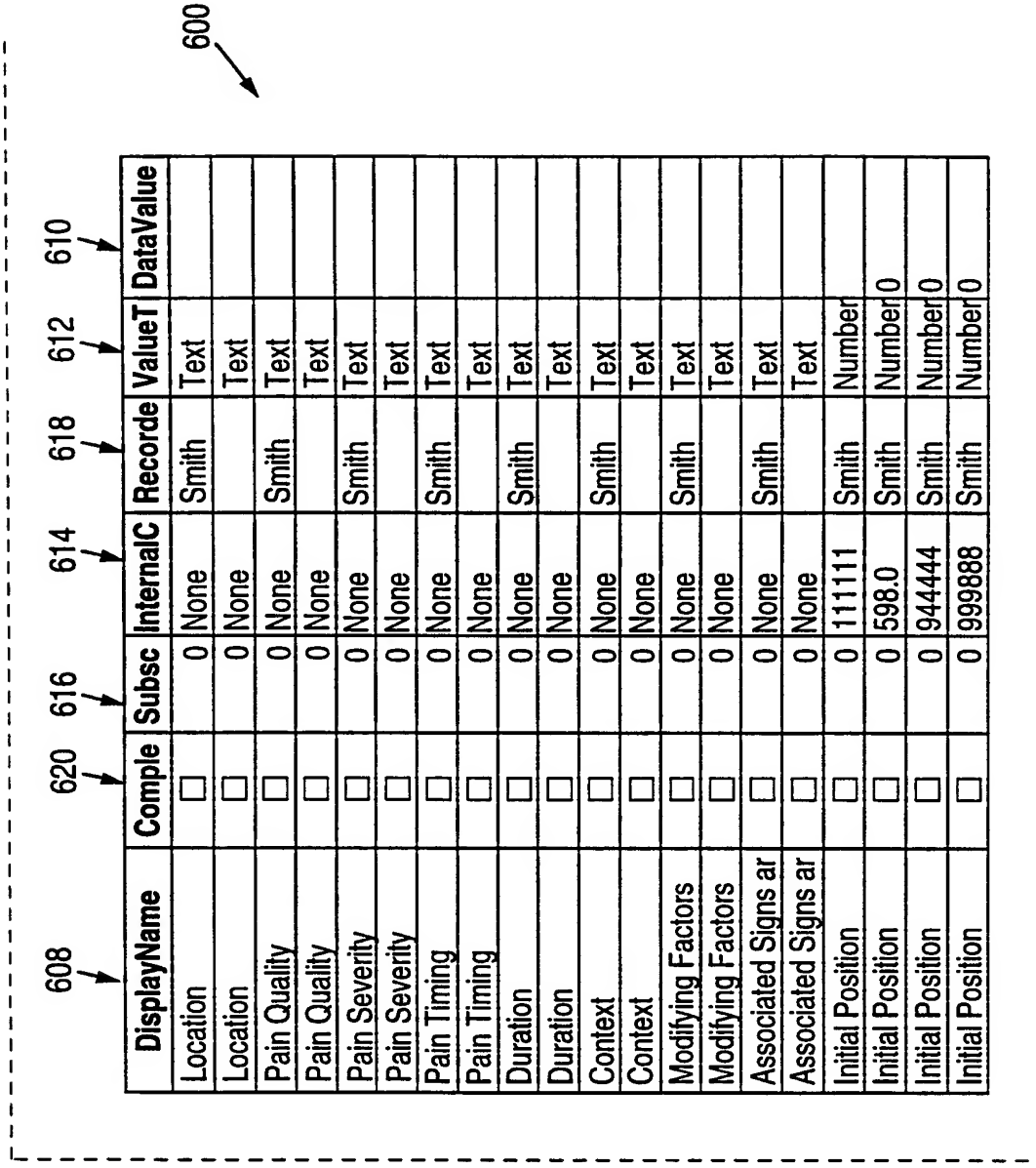

600
608
620
616
614
618
612
610
DisplayName
Comple
Subsc
InternalC
Recorde
ValueT
DataValue
Location 0 None Smith Text
Location 0 None Text
Pain Quality 0 None Smith Text
Pain Quality 0 None Text
Pain Severity 0 None Smith Text
Pain Severity 0 None Text
Pain Timing 0 None Smith Text
Pain Timing 0 None Text
Duration 0 None Smith Text
Duration 0 None Text
Context 0 None Smith Text
Context 0 None Text
Modifying Factors 0 None Smith Text
Modifying Factors 0 None Text
Associated Signs ar 0 None Smith Text
Associated Signs ar 0 None Text
Initial Position 0 111111 Smith Number
Initial Position 0 598.0 Smith Number 0
Initial Position 0 944444 Smith Number 0
Initial Position 0 999888 Smith Number 0

FIG. 6D

```
Elements{Key{Key6}EncounterId{Base}ElementType{CC}AssocProblem{Table6}DisplayName{Chief Complaint}
  Element{Key{CC1}EncounterId{Base}ElementType{CC}DisplayName{Chief Complaint}Complete{False}Value Type{Text}Value{Not Specified}}}
Elements{Key{Key1}EncounterId{Base}ElementType{HPI}AssocProblem{Table1}DisplayName{HPI}
  Element{Key{HPI1}EncounterId{Base}ElementType{HPI}DisplayName{Location}Complete{False}Value Type{Text}Value{Not Specified}}
  Element{Key{HPI2}EncounterId{Base}ElementType{HPI}DisplayName{Pain Quality}Complete{False}Value Type{Text}Value{Not Specified}}
  Element{Key{HPI3}EncounterId{Base}ElementType{HPI}DisplayName{Pain Severity}Complete{False}Value Type{Text}Value{Not Specified}}
  Element{Key{HPI4}EncounterId{Base}ElementType{HPI}DisplayName{Pain Timing}Complete{False}Value Type{Text}Value{Not Specified}}
  Element{Key{HPI5}EncounterId{Base}ElementType{HPI}DisplayName{Duration}Complete{False}Value Type{Text}Value{Not Specified}}
  Element{Key{HPI6}EncounterId{Base}ElementType{HPI}DisplayName{Context}Complete{False}Value Type{Text}Value{Not Specified}}
  Element{Key{HPI7}EncounterId{Base}ElementType{HPI}DisplayName{Modifying Factors}Complete{False}Value Type{Text}Value{Not Specified}}
  Element{Key{HPI8}EncounterId{Base}ElementType{HPI}DisplayName{Associated Signs and Symptoms}Complete{False}Value Type{Text}Value{Not Specified}}}
Elements{Key{Key5}EncounterId{Base}ElementType{MACRO}AssocProblem{Table5}DisplayName{Macros}
  Element{Key{MC1}EncounterId{Base}ElementType{MACRO}DisplayName{pick one}Complete{False}ValueType{Text}Value{Patient reports normal good health
and comes in for a routine review and physical examination.}}
  Element{Key(MC2}}EncounterId{Base}ElementType{MACRO}DisplayName{pick two}Complete{False}ValueType{Text}Value{Patient has recovered and
comes in for a follow-up examination.}}}
Elements{Key{Key4}EncounterId{Base}ElementType{PE}AssocProblem{Table4}DisplayName{Physicial Examination}
  Element{Key{PE1-VS}EncounterId{Base}ElementType{PE}DisplayName{Vital Signs, BP-E; BP-S; P; R; T; H; W}Complete{False}ValueType{Text}Value(Not
Specified}}
  Element{Key{PE2-GenApp}EncounterId{Base}ElementType{PE}DisplayName{General Appearance}Complete{False}ValueType{Text}Value{Not Specified}}
  Element{Key{PE3-Eyes}EncounterId{Base}ElementType{PE}DisplayName{Eyes; Conj/Lids; Pupils/Irises; Optic Discs/Posterior
Segs}Complete{False}ValueType{Text}Value{Not Specified}}
  Element{Key{PE4-ENMT)EncounterId{Base}ElementType{PE}DisplayName{ENMT; Ears/Nose; Hearing; Lips/Teeth/Gums; Otoscope; Nasal
Mucosa/Septum/Turbinates; Oropharynx/Post Pharynx}Complete{False}ValueType{Text}Value{Not Specified}}}
Elements{Key{Key3}EncounterId{Base}ElementType{PFSH}AssocProblem{Table3}DisplayName{PFSH}
  Element{Key{PH1}EncounterId{Base}ElementType{PFSH}DisplayName{Past History}Complete{False}ValueType{Text}Value{Not Specified}}
  Element{Key{PH2}EncounterId{Base}ElementType{PFSH}DisplayName{Family History}Complete{False}ValueType{Text}Value{Not Specified}}
  Element{Key{PH3}EncounterId{Base}ElementType{PFSH}DisplayName{Social History}Complete{False}ValueType{Text}Value{Not Specified}))
Elements{Key{111111}EncounterId{Base}ElementType{PROB}AssocProblem{Table6}DisplayName{Problems}
  Element{Key{InitialPos}EncounterId{Base}ElementType{PROB}DisplayName{InitialPosition}Complete{False}ValueType{Number}Value{Not Specified}}
```

Fig. 7A

FIG. 7

FIG. 7A
FIG. 7B

```
Element{Key{CurrentPos}EncounterId{Base}ElementType{PROB}DisplayName{CurrentPosition}Complete{False}ValueType{Number}Value{Not Specified}}
Element{Key{Started}EncounterId{Base}ElementType{PROB}DisplayName{Started}Complete{False}ValueType{Text}Value{Not Specified}}
Element{Key{DateInactive}EncounterId{Base}ElementType{PROB}DisplayName{Designated Inactive}Complete{False}ValueType{Date}Value{Not Specified}}
Element{Key{Severity}EncounterId{Base}ElementType{PROB}DisplayName{Current Severity}Complete{False}ValueType{Text}Value{NotSpecified}}
Element{Key{ProblemStatement}EncounterId{Base}ElementType{PROB}DisplayName{Problem Statement}Complete{False}ValueType{Text}Value
{Diabetes Mellitus}}}
Elements{Key{598.0}EncounterId{Base}ElementType{PROB}AssocProblem{Active}DisplayName{Problems}
  Element{Key{InitialPos}EncounterId{Base}ElementType{PROB}DisplayName{InitialPosition}Complete{False}ValueType{Number}Value{0}}
  Element{Key{CurrentPos}EncounterId{Base}ElementType{PROB}DisplayName{CurrentPosition}Complete{False}ValueType{Number}Value{0}}
  Element{Key{Started}EncounterId{Base}ElementType{PROB}DisplayName{Started}Complete{False}ValueType{Date}}
  Element{Key{DateInactive}EncounterId{Base}ElementType{PROB}DisplayName{Designated Inactive}Complete{False}ValueType{Date}}
  Element{Key{Severity}EncounterId{Base}ElementType{PROB}DisplayName{CurrentSeverity}Complete{False}ValueType{Number}Value{0}}
  Element{Key{ProblemStatement}EncounterId{Base}ElementType{PROB}DisplayName{Problem Statement}Complete{False}ValueType{Text}Value
{Urethral stricture due to infection}}}
Elements{Key{999888}EncounterId{Base}ElementType{PROB}AssocProblem{Table0}DisplayName{Problems}
  Element{Key{InitialPos}EncounterId{Base}ElementType{PROB}DisplayName{InitialPosition}Complete{False}ValueType{Number}Value{0}}
  Element{Key{CurrentPos}EncounterId{Base}ElementType{PROB}DisplayName{CurrentPosition}Complete{False}ValueType{Number}Value{0}}
  Element{Key{Started}EncounterId{Base}ElementType{PROB}DisplayName{Started}Complete{False}ValueType{Date}}
  Element{Key{DateInactive}EncounterId{Base}ElementType{PROB}DisplayName{Designated Inactive}Complete{False}ValueType{Date}}
  Element{Key{Severity}EncounterId{Base}ElementType{PROB}DisplayName{CurrentSeverity}Complete{False}ValueType{Number}Value{0}}
  Element{Key{ProblemStatement}EncounterId{Base}ElementType{PROB}DisplayName{Problem Statement}Complete{False}ValueType{Text}Value
{Bladder Neck Obstruction}}}
Elements{Key{944444}EncounterId{Base}ElementType{PROB}AssocProblem{Table6}DisplayName{Problems}
  Element{Key{InitialPos}EncounterId{Base}ElementType{PROB}DisplayName{InitialPosition}Complete{False}ValueType{Number}Value{0}}
  Element{Key{CurrentPos}EncounterId{Base}ElementType{PROB}DisplayName{CurrentPosition}Complete{False}ValueType{Number}Value{0}}
  Element{Key{Started}EncounterId{Base}ElementType{PROB}DisplayName{Started}Complete{False}ValueType{Date}Value{NotSpecified}}
  Element{Key{DateInactive}EncounterId{Base}ElementType{PROB}DisplayName{Designated Inactive}Complete{False}ValueType{Date}Value{Not Specified}}
```

Fig. 7B

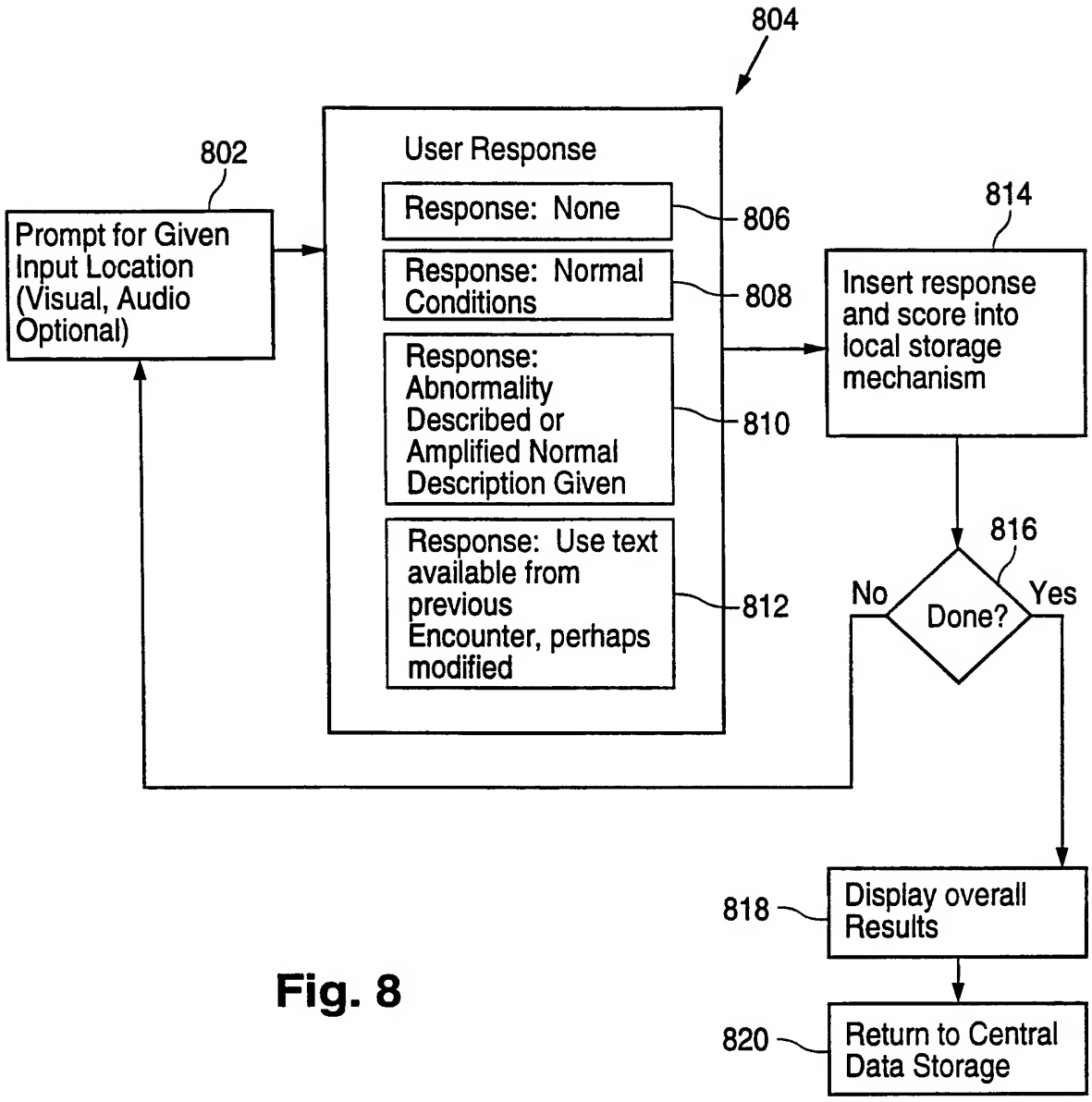

804
802
User Response
Prompt for Given Input Location (Visual, Audio Optional)
Response: None
806
Response: Normal Conditions
808
Response: Abnormality Described or Amplified Normal Description Given
810
Response: Use text available from previous Encounter, perhaps modified
812
814
Insert response and score into local storage mechanism
816
No
Done?
Yes
818
Display overall Results
820
Return to Central Data Storage

Fig. 8

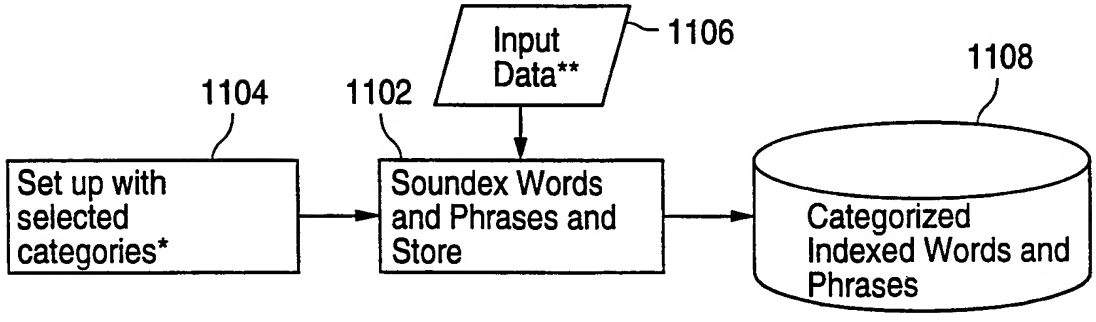

1104
1102
Input Data**
1106
1108
Set up with selected categories*
Soundex Words and Phrases and Store
Categorized Indexed Words and Phrases

Fig. 11

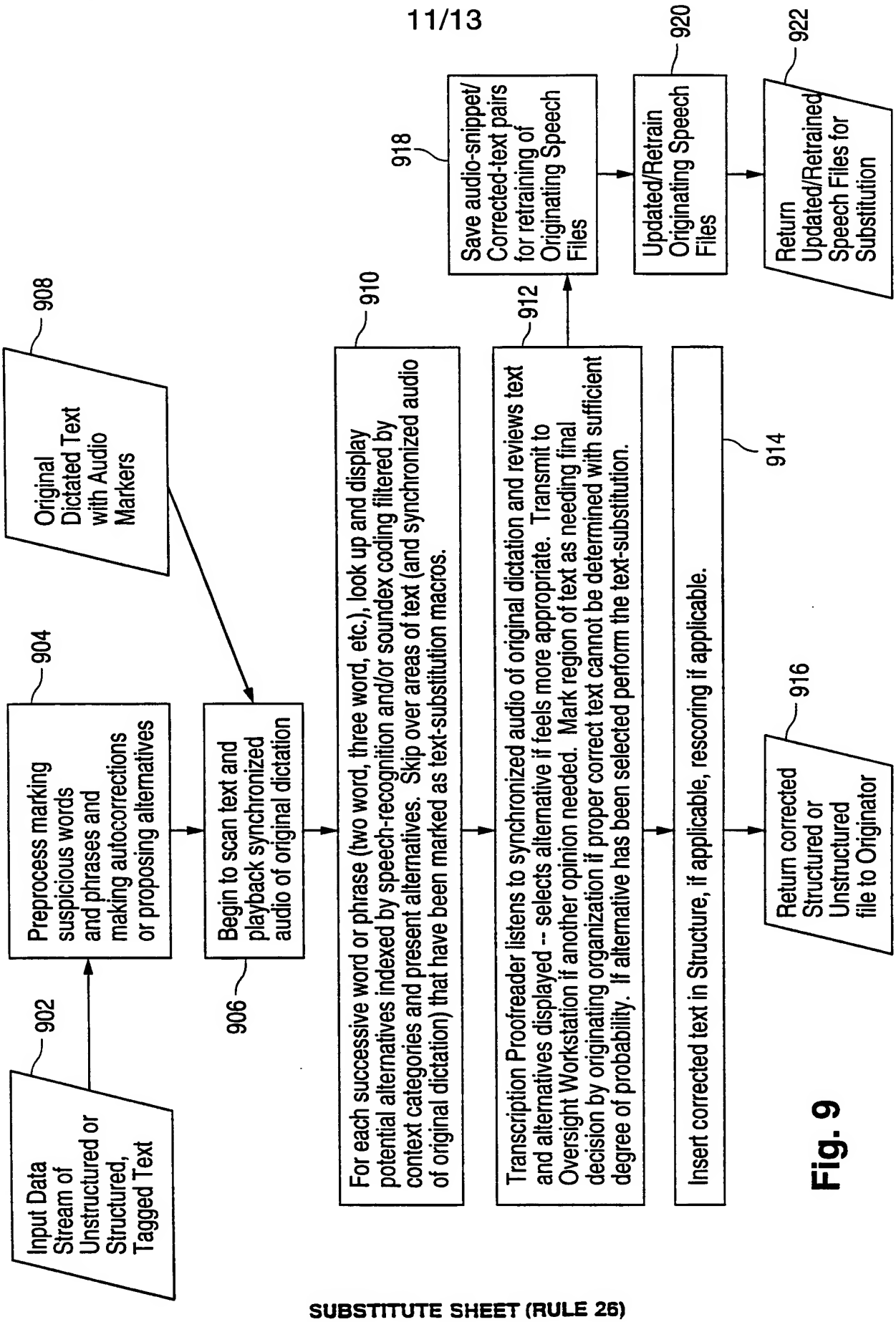

Input Data Stream of Unstructured or Structured, Tagged Text
902
Preprocess marking suspicious words and phrases and making autocorrections or proposing alternatives
904
Original Dictated Text with Audio Markers
908
Begin to scan text and playback synchronized audio of original dictation
906
For each successive word or phrase (two word, three word, etc.), look up and display potential alternatives indexed by speech-recognition and/or soundex coding filtered by context categories and present alternatives. Skip over areas of text (and synchronized audio of original dictation) that have been marked as text-substitution macros.
910
Transcription Proofreader listens to synchronized audio of original dictation and reviews text and alternatives displayed -- selects alternative if feels more appropriate. Transmit to Oversight Workstation if another opinion needed. Mark region of text as needing final decision by originating organization if proper correct text cannot be determined with sufficient degree of probability. If alternative has been selected perform the text-substitution.
912
Insert corrected text in Structure, if applicable, rescoring if applicable.
914
Return corrected Structured or Unstructured file to Originator
916
Save audio-snippet/ Corrected-text pairs for retraining of Originating Speech Files
918
Updated/Retrain Originating Speech Files
920
Return Updated/Retrained Speech Files for Substitution
922

Fig. 9

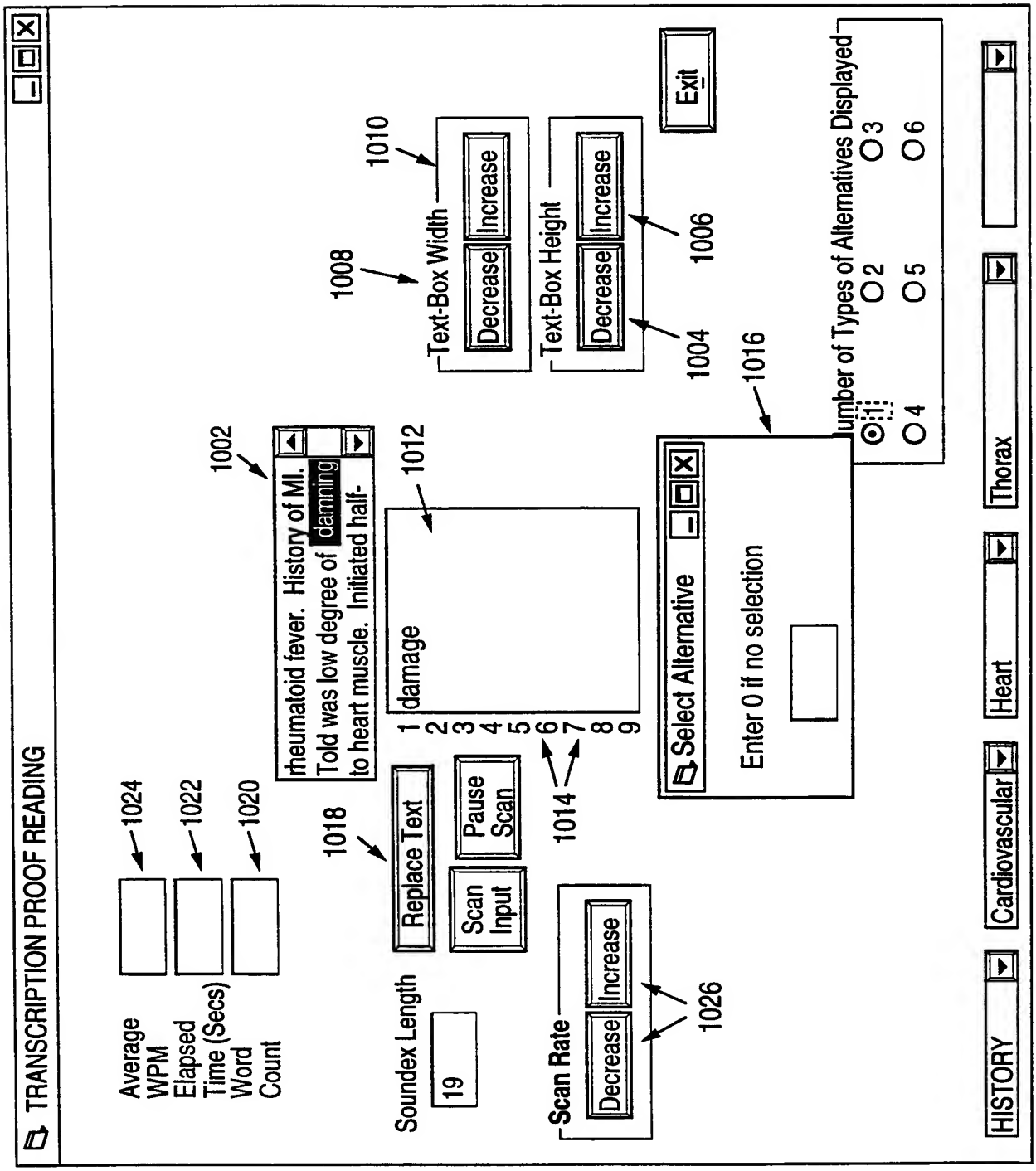

TRANSCRIPTION PROOF READING
Average WPM
Elapsed Time (Secs)
Word Count
1024
1022
1020
1002
rheumatoid fever. History of MI. Told was low degree of damning to heart muscle. Initiated half-
1018
Replace Text
Scan Input
Pause Scan
1014
1012
damage
1 2 3 4 5 6 7 8 9
Soundex Length
19
Scan Rate
Decrease
Increase
1026
1008
1010
Text-Box Width
Decrease
Increase
Text-Box Height
Decrease
Increase
1004
1006
Exit
Select Alternative
1016
Enter 0 if no selection
Number of Types of Alternatives Displayed
O 1
O 2
O 3
O 4
O 5
O 6
HISTORY
Cardiovascular
Heart
Thorax

Fig. 10

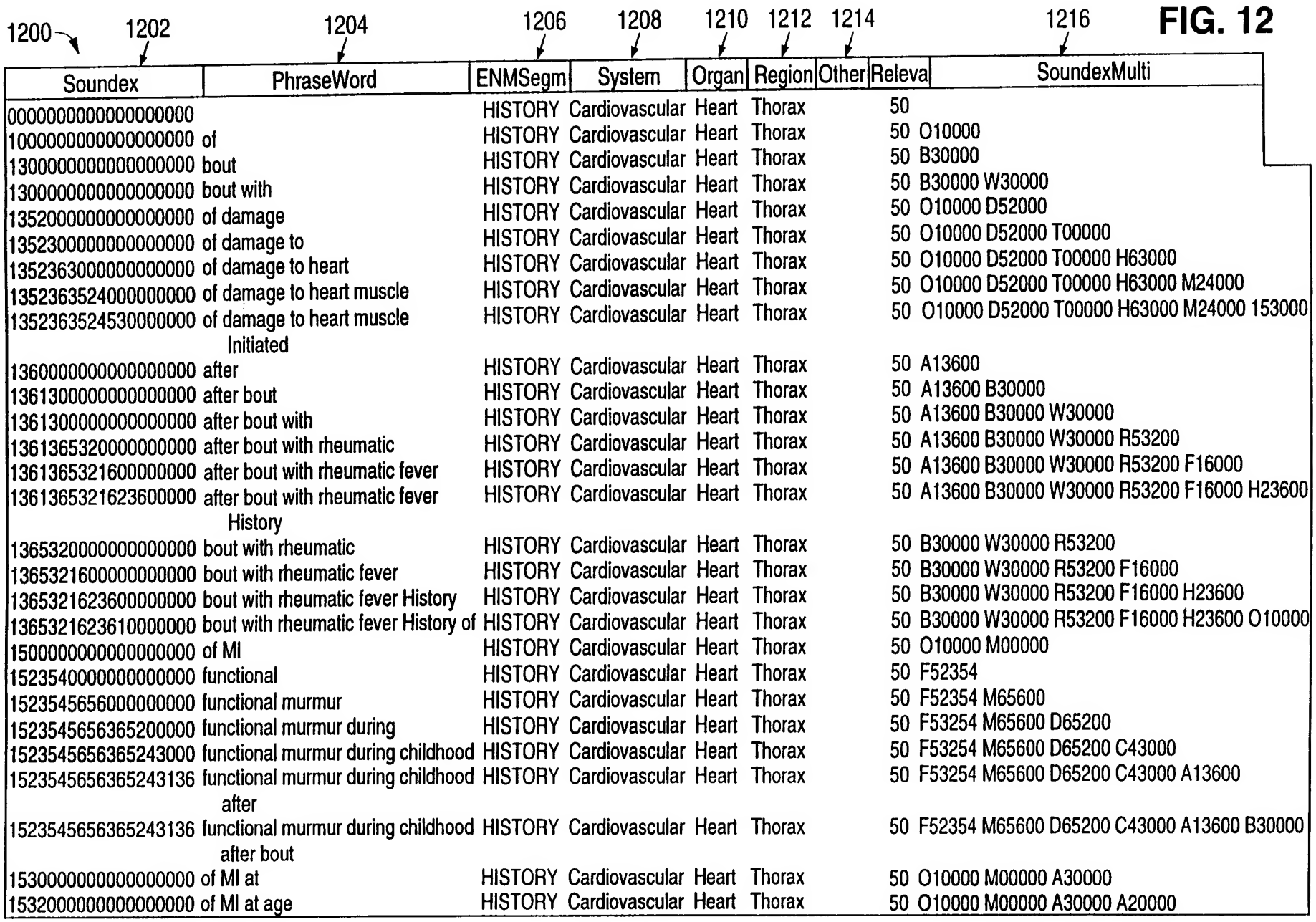


FIG. 12

Soundex	PhraseWord	ENMSegm	System	Organ	Region	Other	Releva	SoundexMulti
0000000000000000000		HISTORY	Cardiovascular	Heart	Thorax		50	
1000000000000000000	of	HISTORY	Cardiovascular	Heart	Thorax		50	O10000
1300000000000000000	bout	HISTORY	Cardiovascular	Heart	Thorax		50	B30000
1300000000000000000	bout with	HISTORY	Cardiovascular	Heart	Thorax		50	B30000 W30000
1352000000000000000	of damage	HISTORY	Cardiovascular	Heart	Thorax		50	O10000 D52000
1352300000000000000	of damage to	HISTORY	Cardiovascular	Heart	Thorax		50	O10000 D52000 T00000
1352363000000000000	of damage to heart	HISTORY	Cardiovascular	Heart	Thorax		50	O10000 D52000 T00000 H63000
1352363524000000000	of damage to heart muscle	HISTORY	Cardiovascular	Heart	Thorax		50	O10000 D52000 T00000 H63000 M24000
1352363524530000000	of damage to heart muscle Initiated	HISTORY	Cardiovascular	Heart	Thorax		50	O10000 D52000 T00000 H63000 M24000 153000
1360000000000000000	after	HISTORY	Cardiovascular	Heart	Thorax		50	A13600
1361300000000000000	after bout	HISTORY	Cardiovascular	Heart	Thorax		50	A13600 B30000
1361300000000000000	after bout with	HISTORY	Cardiovascular	Heart	Thorax		50	A13600 B30000 W30000
1361365320000000000	after bout with rheumatic	HISTORY	Cardiovascular	Heart	Thorax		50	A13600 B30000 W30000 R53200
1361365321600000000	after bout with rheumatic fever	HISTORY	Cardiovascular	Heart	Thorax		50	A13600 B30000 W30000 R53200 F16000
1361365321623600000	after bout with rheumatic fever History	HISTORY	Cardiovascular	Heart	Thorax		50	A13600 B30000 W30000 R53200 F16000 H23600
1365320000000000000	bout with rheumatic	HISTORY	Cardiovascular	Heart	Thorax		50	B30000 W30000 R53200
1365321600000000000	bout with rheumatic fever	HISTORY	Cardiovascular	Heart	Thorax		50	B30000 W30000 R53200 F16000
1365321623600000000	bout with rheumatic fever History	HISTORY	Cardiovascular	Heart	Thorax		50	B30000 W30000 R53200 F16000 H23600
1365321623610000000	bout with rheumatic fever History of	HISTORY	Cardiovascular	Heart	Thorax		50	B30000 W30000 R53200 F16000 H23600 O10000
1500000000000000000	of MI	HISTORY	Cardiovascular	Heart	Thorax		50	O10000 M00000
1523540000000000000	functional	HISTORY	Cardiovascular	Heart	Thorax		50	F52354
1523545656000000000	functional murmur	HISTORY	Cardiovascular	Heart	Thorax		50	F52354 M65600
1523545656365200000	functional murmur during	HISTORY	Cardiovascular	Heart	Thorax		50	F53254 M65600 D65200
1523545656365243000	functional murmur during childhood	HISTORY	Cardiovascular	Heart	Thorax		50	F53254 M65600 D65200 C43000
1523545656365243136	functional murmur during childhood after	HISTORY	Cardiovascular	Heart	Thorax		50	F53254 M65600 D65200 C43000 A13600
1523545656365243136	functional murmur during childhood after bout	HISTORY	Cardiovascular	Heart	Thorax		50	F52354 M65600 D65200 C43000 A13600 B30000
1530000000000000000	of MI at	HISTORY	Cardiovascular	Heart	Thorax		50	O10000 M00000 A30000
1532000000000000000	of MI at age	HISTORY	Cardiovascular	Heart	Thorax		50	O10000 M00000 A30000 A20000

INTERNATIONAL SEARCH REPORT

national application No.
PCT/US00/29649

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :G 10 L /15/00
US CL : 704/235, 251, 260

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 704/235, 251, 260

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST, WEST, non patent literatures

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,799,273 A [MITCHELL et al.] 25 August 1998, Fig.1-5	1-41
Y	US 4,914,704 A [COLE et al.) 03 April 1990, Fig.1 col2, line 20-col.3, line 10.	1-41
Y	US 5,909,667 A [LEONTIADES et al.] 01 June 1999, Fig.1-9	1-41
Y,P	US 6,081,772 A [LEWIS] 27 June 2000, abstract	1-41

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search	Date of mailing of the international search report
30 NOVEMBER 2000	29 DEC 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer David Hudspeth Telephone No. (703) 308-4825

Form PCT/ISA/210 (second sheet) (July 1998) ★